Pushbutton On/Off Controller with µP Interrupt

FEATURES

- **Adjustable Power On/Off Timers**
- **Low Supply Current: 6µA**
- **Wide Operating Voltage Range: 2.7V to 26.4V**
- **Low Leakage EN Output (LTC2954-1) Allows DC/DC Converter Control**
- **High Voltage $\overline{EN}$ Output (LTC2954-2) Allows Circuit Breaker Control**
- **Simple Interface Allows Graceful µP Shutdown**
- High Input Voltage $\overline{PB}$ Pin with Internal Pull-Up Resistor
- ±10kV ESD HBM on $\overline{PB}$ Input
- Accurate 0.6V Threshold on $\overline{KILL}$ Comparator Input
- 8-Pin 3mm × 2mm DFN and ThinSOT™ Packages

APPLICATIONS

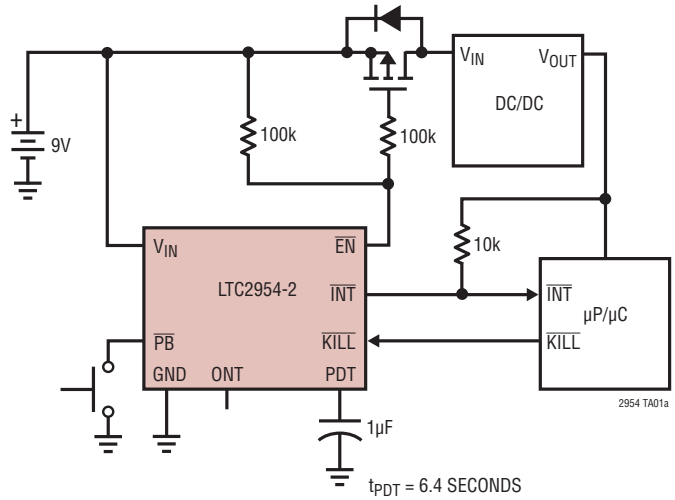
- Pushbutton PowerPath™ Control
- Portable Instrumentation Meters
- Blade Servers
- Portable Customer Service PDA
- Desktop and Notebook Computers

DESCRIPTION

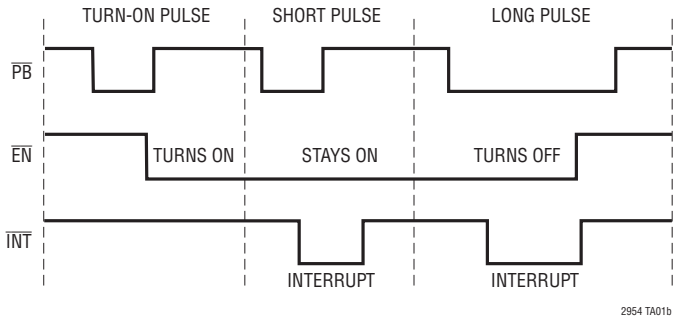
The LTC®2954 is a pushbutton on/off controller that manages system power via a pushbutton interface. An enable output toggles system power while an interrupt output provides debounced pushbutton status. The interrupt output can be used in menu driven applications to request a system power-down. A power kill input allows a microprocessor or system to reset the enable output, effectively powering down the system. Independently adjustable on and off timers allow dependable pushbutton control of the enable output and resistance to accidental toggling of system power.

The LTC2954 operates over a wide 2.7V to 26.4V input voltage range to accommodate a wide variety of input power supplies. Very low quiescent current (6µA typical) makes the LTC2954 ideally suited for battery powered applications. Two versions of the part are available to accommodate either positive or negative enable polarities.

TYPICAL APPLICATION



Pushbutton On/Off with Interrupt



LTC2954

带微处理器中断的按键开关控制器

特性

- **可调电源开启/关闭定时器**
- **低供电电流：6µA**
- **宽工作电压范围：2.7V至26.4V**
- **低漏电EN输出（LTC2954-1）支持DC/DC转换器控制**
- **高压EN输出（LTC2954-2）支持断路器控制**
- **简单接口支持微处理器优雅关机**
- 带内部上拉电阻的高输入电压$\overline{PB}$引脚
- $\overline{PB}$输入端支持±10kV人体模型静电放电（ESD）
- 精确的0.6V阈值 $\overline{KILL}$比较器输入
- 8引脚3mm × 2mm DFN和ThinSOT™封装

应用

- 按键开关PowerPath™控制
- 便携式仪器仪表
- 刀片服务器
- 便携式客户服务PDA
- 台式机和笔记本电脑

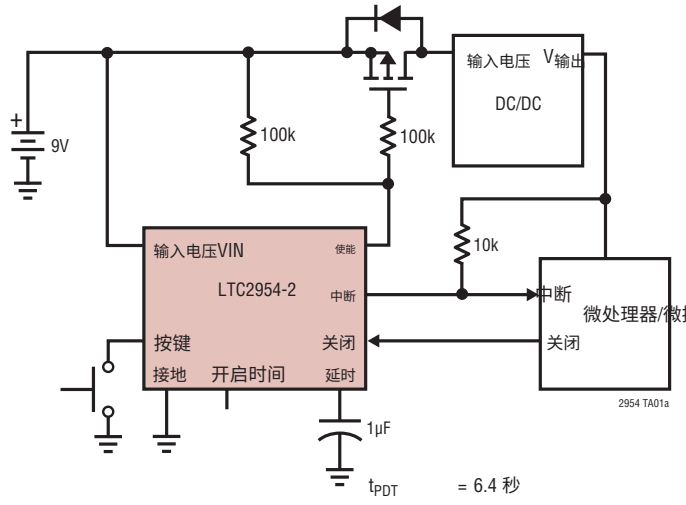
产品描述

LTC®2954是一款通过按键开关接口管理系统电源的按键开/关控制器。使能输出切换系统电源，中断输出提供消抖后的按键开关状态。中断输出可用于菜单驱动应用中请求系统断电。电源关闭输入允许微处理器或系统复位使能输出，从而有效关闭系统电源。独立可调的开启和关闭定时器确保使能输出的可靠按键控制，防止系统电源意外切换。

LTC2954支持宽输入电压范围2.7V至26.4V，以适应多种输入电源。极低的静态电流（典型值6µA）使LTC2954非常适合电池供电应用。

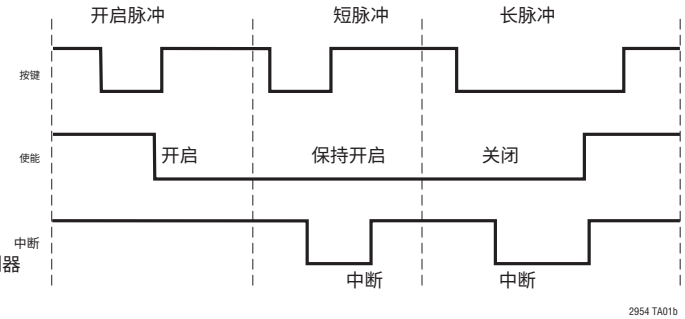
该器件提供两种版本，以适应正极性或负极性使能输出。

典型应用



t_{PDT} = 6.4 秒

带中断的按键开/关控制器

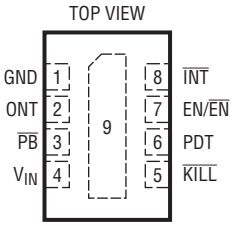


ABSOLUTE MAXIMUM RATINGS (Note 1)

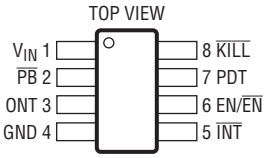
Supply Voltage (V_{IN}) ..... –0.3V to 33V
Input Voltages
  $\overline{PB}$ ..... –6V to 33V
  ONT ..... –0.3V to 2.7V
  PDT ..... –0.3V to 2.7V
  $\overline{KILL}$ ..... –0.3V to 7V
Output Voltages
  $\overline{INT}$ ..... –0.3V to 10V
  EN/$\overline{EN}$ ..... –0.3V to 33V

Operating Temperature Range
  LTC2954C-1 ..... 0°C to 70°C
  LTC2954C-2 ..... 0°C to 70°C
  LTC2954I-1 ..... –40°C to 85°C
  LTC2954I-2 ..... –40°C to 85°C
Storage Temperature Range
  DFN Package ..... –65°C to 125°C
  TSOT-23 ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PIN CONFIGURATION



DDB PACKAGE
8-LEAD (3mm × 2mm) PLASTIC DFN
T_{JMAX} = 125°C, θ_{JA} = 165°C/W
EXPOSED PAD (PIN 9) PCB GND CONNECTION OPTIONAL



TS8 PACKAGE
8-LEAD PLASTIC TSOT-23
T_{JMAX} = 125°C, θ_{JA} = 140°C/W

ORDER INFORMATION

LEAD FREE FINISH	TAPE AND REEL	PART MARKING*	PACKAGE DESCRIPTION	TEMPERATURE RANGE
LTC2954CDDB-1#PBF	LTC2954CDDB-1#TRPBF	LCJG	8-Lead (3mm × 2mm) Plastic DFN	0°C to 70°C
LTC2954CDDB-2#PBF	LTC2954CDDB-2#TRPBF	LCNJ	8-Lead (3mm × 2mm) Plastic DFN	0°C to 70°C
LTC2954IDDB-1#PBF	LTC2954IDDB-1#TRPBF	LCJG	8-Lead (3mm × 2mm) Plastic DFN	–40°C to 85°C
LTC2954IDDB-2#PBF	LTC2954IDDB-2#TRPBF	LCNJ	8-Lead (3mm × 2mm) Plastic DFN	–40°C to 85°C
LTC2954CTS8-1#PBF	LTC2954CTS8-1#TRPBF	LTCJH	8-Lead Plastic TSOT-23	0°C to 70°C
LTC2954CTS8-2#PBF	LTC2954CTS8-2#TRPBF	LTCNK	8-Lead Plastic TSOT-23	0°C to 70°C
LTC2954ITS8-1#PBF	LTC2954ITS8-1#TRPBF	LTCJH	8-Lead Plastic TSOT-23	–40°C to 85°C
LTC2954ITS8-2#PBF	LTC2954ITS8-2#TRPBF	LTCNK	8-Lead Plastic TSOT-23	–40°C to 85°C
LEAD BASED FINISH	**TAPE AND REEL**	**PART MARKING***	**PACKAGE DESCRIPTION**	**TEMPERATURE RANGE**
LTC2954CDDB-1	LTC2954CDDB-1#TR	LCJG	8-Lead (3mm × 2mm) Plastic DFN	0°C to 70°C
LTC2954CDDB-2	LTC2954CDDB-2#TR	LCNJ	8-Lead (3mm × 2mm) Plastic DFN	0°C to 70°C
LTC2954IDDB-1	LTC2954IDDB-1#TR	LCJG	8-Lead (3mm × 2mm) Plastic DFN	–40°C to 85°C
LTC2954IDDB-2	LTC2954IDDB-2#TR	LCNJ	8-Lead (3mm × 2mm) Plastic DFN	–40°C to 85°C
LTC2954CTS8-1	LTC2954CTS8-1#TR	LTCJH	8-Lead Plastic TSOT-23	0°C to 70°C
LTC2954CTS8-2	LTC2954CTS8-2#TR	LTCNK	8-Lead Plastic TSOT-23	0°C to 70°C
LTC2954ITS8-1	LTC2954ITS8-1#TR	LTCJH	8-Lead Plastic TSOT-23	–40°C to 85°C
LTC2954ITS8-2	LTC2954ITS8-2#TR	LTCNK	8-Lead Plastic TSOT-23	–40°C to 85°C

Consult LTC Marketing for parts specified with wider operating temperature ranges. *The temperature grade is identified by a label on the shipping container.

For more information on lead free part marking, go to: http://www.linear.com/leadfree/
For more information on tape and reel specifications, go to: http://www.linear.com/tapeandreel/

绝对最大额定值

(注1)

电源电压 (输入电压VIN) .....–0.3V 至 33V

输入电压

- 按键.....–6V 至 33V
- 开启.....–0.3V 至 2.7V
- 延时.....–0.3V 至 2.7V
- 关闭.....–0.3V 至 7V

输出电压

- 中断.....–0.3V 至 10V
- 使能/使能.....–0.3V 至 33V

工作温度范围

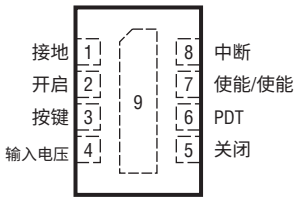
- LTC2954C-1.....0°C 至 70°C
- LTC2954C-2.....0°C 至 70°C
- LTC2954I-1 .....–40°C 至 85°C
- LTC2954I-2 .....–40°C 至 85°C

存储温度范围

- DFN 封装..... .–65°C 至 125°C
- TSOT-23 封装.....–65°C 至 150°C

引脚温度（焊接，10 秒） ....300°C

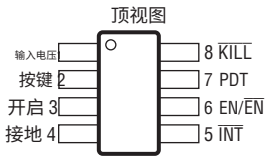
引脚配置



DDB封装 8引脚（3mm×2mm）塑料DFN

结温最大T_{JMAX}= 125°C，热阻 θ_{JA}= 165°C/W

裸露焊盘（引脚9）PCB接地连接（可选）



TS8 封装 8
引脚塑料 TSOT-23

TJMAX = 125°C, θ_{JA} = 140°C/W

订购信息

无铅表面处理	卷带包装	器件标记*	封装说明	温度范围
LTC2954CDDB-1#PBF	LTC2954CDDB-1#TRPBF	LCJG	8 引脚（3mm ×2mm）塑料 DFN 封装	0°C 至 70°C
LTC2954CDDB-2#PBF	LTC2954CDDB-2#TRPBF	LCNJ	8 引脚（3mm ×2mm）塑料 DFN 封装	0°C 至 70°C
LTC2954IDDB-1#PBF	LTC2954IDDB-1#TRPBF	LCJG	8 引脚（3mm ×2mm）塑料 DFN 封装	–40°C 至 85°C
LTC2954IDDB-2#PBF	LTC2954IDDB-2#TRPBF	LCNJ	8 引脚（3mm ×2mm）塑料 DFN 封装	–40°C 至 85°C
LTC2954CTS8-1#PBF	LTC2954CTS8-1#TRPBF	LTCJH	8 引脚塑料 TSOT-23 封装	0°C 至 70°C
LTC2954CTS8-2#PBF	LTC2954CTS8-2#TRPBF	LTCNK	8 引脚塑料 TSOT-23 封装	0°C 至 70°C
LTC2954ITS8-1#PBF	LTC2954ITS8-1#TRPBF	LTCJH	8 引脚塑料 TSOT-23 封装	–40°C 至 85°C
LTC2954ITS8-2#PBF	LTC2954ITS8-2#TRPBF	LTCNK	8 引脚塑料 TSOT-23 封装	–40°C 至 85°C
含铅表面处理	**卷带包装**	**器件标记***	**封装说明**	**温度范围**
LTC2954CDDB-1	LTC2954CDDB-1#TR	LCJG	8 引脚（3mm ×2mm）塑料 DFN 封装	0°C 至 70°C
LTC2954CDDB-2	LTC2954CDDB-2#TR	LCNJ	8 引脚（3mm ×2mm）塑料 DFN 封装	0°C 至 70°C
LTC2954IDDB-1	LTC2954IDDB-1#TR	LCJG	8 引脚（3mm ×2mm）塑料 DFN 封装	–40°C 至 85°C
LTC2954IDDB-2	LTC2954IDDB-2#TR	LCNJ	8 引脚（3mm ×2mm）塑料 DFN 封装	–40°C 至 85°C
LTC2954CTS8-1	LTC2954CTS8-1#TR	LTCJH	8 引脚塑料 TSOT-23 封装	0°C 至 70°C
LTC2954CTS8-2	LTC2954CTS8-2#TR	LTCNK	8 引脚塑料 TSOT-23 封装	0°C 至 70°C
LTC2954ITS8-1	LTC2954ITS8-1#TR	LTCJH	8 引脚塑料 TSOT-23 封装	–40°C 至 85°C
LTC2954ITS8-2	LTC2954ITS8-2#TR	LTCNK	8 引脚塑料 TSOT-23 封装	–40°C 至 85°C

有关宽温度范围规格的型号，请咨询LTC市场部。*温度等级由运输容器上的标签标识。

有关无铅零件标识的更多信息，请访问：http://www.linear.com/leadfree/
有关卷带规格的更多信息，请访问：http://www.linear.com/tapeandreel/

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_{IN} = 2.7V to 26.4V, unless otherwise noted. (Note 2)

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{IN}	Supply Voltage Range	Steady State Operation	●	2.7		26.4	V
I_{IN}	V_{IN} Supply Current	System Power-On, V_{IN} = 2.7V to 24V	●		6	12	µA
V_{UVL}	V_{IN} Undervoltage Lockout	V_{IN} Falling	●	2.2	2.3	2.5	V
$V_{UVL(HYST)}$	V_{IN} Undervoltage Lockout Hysteresis			50	400	700	mV
Pushbutton, Enable ($\overline{PB}$, EN/$\overline{EN}$))							
$V_{\overline{PB}(MIN, MAX)}$	$\overline{PB}$ Voltage Range	Single-Ended	●	–1		26.4	V
$I_{\overline{PB}}$	$\overline{PB}$ Input Current	2.5V < $V_{\overline{PB}}$ < 26.4V $V_{\overline{PB}}$ = 1V $V_{\overline{PB}}$ = 0.6V	● ● ●	 –1 –3	 –6 –9	±1 –12 –15	µA µA µA
$V_{\overline{PB}(VTH)}$	$\overline{PB}$ Input Threshold	$\overline{PB}$ Falling	●	0.6	0.8	1	V
$V_{\overline{PB}(VOC)}$	$\overline{PB}$ Open Circuit Voltage	$I_{\overline{PB}}$ = –1µA		1	1.6	2	V
$t_{EN, LOCKOUT}$	EN/$\overline{EN}$ Lockout Time (Note 5)	Enable Released → Enable Asserted	●	200	256	325	ms
$I_{EN(LKG)}$	EN/$\overline{EN}$ Leakage Current	$V_{EN/\overline{EN}}$ = 1V, Sink Current Off $V_{EN/\overline{EN}}$ = 26.4V, Sink Current Off	● ●			±0.1 ±1	µA µA
$V_{EN(VOL)}$	EN/$\overline{EN}$ Voltage Output Low	$I_{EN/\overline{EN}}$ = 500µA	●		0.11	0.4	V
Power-On Timing Pin (ONT)							
$I_{ONT(PU)}$	ONT Pull-Up Current	V_{ONT} = 0V	●	–2.4	–3	–3.6	µA
$I_{ONT(PD)}$	ONT Pull-Down Current	V_{ONT} = 1.3V	●	2.4	3	3.6	µA
$t_{DB, ON}$	Internal Turn-On Debounce Time	ONT Pin Float, $\overline{PB}$ Falling → Enable Asserted	●	26	32	41	ms
t_{ONT}	Additional Adjustable Turn-On Time	C_{ONT} = 1500pF	●	9	11.5	13.5	ms
Power-Down Timing Pin (PDT)							
$I_{PDT(PU)}$	PDT Pull-Up Current	V_{PDT} = 0V	●	–2.4	–3	–3.6	µA
$I_{PDT(PD)}$	PDT Pull-Down Current	V_{PDT} = 1.3V	●	2.4	3	3.6	µA
$t_{DB, OFF}$	Turn-Off Interrupt Debounce Time	$\overline{PB}$ Falling → $\overline{INT}$ Falling	●	26	32	41	ms
$t_{PD, MIN}$	Internal $\overline{PB}$ Power-Down Debounce Time (Note 4)	PDT Pin Float, $\overline{PB}$ Falling → Enable Released	●	52	64	82	ms
t_{PDT}	Additional Adjustable $\overline{PB}$ Power-Down Debounce Time	C_{PDT} = 1500pF	●	9	11.5	13.5	ms
$t_{\overline{INT}, MIN}$	Minimum $\overline{INT}$ Pulse Width	$\overline{INT}$ Asserted → $\overline{INT}$ Released	●	26	32	41	ms
$t_{\overline{INT}, MAX}$	Maximum $\overline{INT}$ Pulse Width	C_{PDT} = 1500pF, $\overline{INT}$ Asserted → $\overline{INT}$ Released	●	35	43.5	54.5	ms
µP Handshake Pins ($\overline{INT}$, $\overline{KILL}$)							
$I_{\overline{INT}(LKG)}$	$\overline{INT}$ Leakage Current	$V_{\overline{INT}}$ = 3V	●			±1	µA
$V_{\overline{INT}(VOL)}$	$\overline{INT}$ Output Voltage Low	$I_{\overline{INT}}$ = 3mA	●		0.11	0.4	V
$V_{\overline{KILL}(TH)}$	$\overline{KILL}$ Input Threshold Voltage	$\overline{KILL}$ Falling	●	0.57	0.6	0.63	V
$V_{\overline{KILL}(HYST)}$	$\overline{KILL}$ Input Threshold Hysteresis		●	10	30	50	mV
$I_{\overline{KILL}(LKG)}$	$\overline{KILL}$ Leakage Current	$V_{\overline{KILL}}$ = 0.6V	●			±0.1	µA
$t_{\overline{KILL}(PW)}$	$\overline{KILL}$ Minimum Pulse Width		●	30			µs
$t_{\overline{KILL}(PD)}$	$\overline{KILL}$ Propagation Delay	$\overline{KILL}$ Falling → Enable Released	●			30	µs
$t_{\overline{KILL}, ON BLANK}$	$\overline{KILL}$ Turn-On Blanking (Note 3)	$\overline{KILL}$ = Low, Enable Asserted → Enable Released	●	400	512	650	ms

电气特性

I表示适用于全工作温度范围的规格，否则规格均为环境温度

TA= 25°C。 VIN= 2.7V 至 26.4V，除非另有说明。 （注 2）

符号	参数	条件		最小值	典型值	最大值	单位
输入电压VIN	电源电压范围	稳态工作	●	2.7		26.4	V
我输入	电压输入供电电流	系统上电，电压输入= 2.7V 至 24V	●		6	12	µA
电压欠压锁定	电压输入欠压锁定	电压输入下降	●	2.2	2.3	2.5	V
电压欠压锁定（迟滞）	电压输入欠压锁定迟滞			50	400	700	毫伏
按键开关，启用（$\overline{PB}$，EN/$\overline{EN}$）							
电压$\overline{PB}$（最小值，最大值）	$\overline{PB}$ 电压范围	单端	●	–1		26.4	V
电流$\overline{PB}$	$\overline{PB}$ 输入电流	2.5V < 电压$_{\overline{PB}}$< 26.4V 电压$_{\overline{PB}}$= 1V V按键= 0.6V	● ● ●	 –1 –3	 –6 –9	±1 –12 –15	µA µA µA
$V_{按键(VTH)}$	按键输入阈值	按键下降沿	●	0.6	0.8	1	V
$V_{按键(VOC)}$	按键开路电压	I按键= –1µA		1	1.6	2	V
$t_{使能}$，锁定时间	使能/使能锁定时间（注5）	使能释放 →使能断言	●	200	256	325	毫秒
$I_{使能}$（漏电流）	使能/使能漏电流	V使能/使能= 1V，漏电流关闭 V使能/使能= 26.4V，漏电流关闭	● ●			±0.1 ±1	µA µA
$V_{使能(VOL)}$	EN/$\overline{EN}$ 电压输出低	$I_{EN/\overline{EN}}$ = 500µA	●		0.11	0.4	V
上电定时引脚 (ONT)							
$I_{ONT(PU)}$	ONT 上拉电流	V_{ONT} = 0V	●	–2.4	–3	–3.6	µA
$I_{ONT(PD)}$	ONT 下拉电流	V_{ONT} = 1.3V	●	2.4	3	3.6	µA
$t_{DB, ON}$	内部开启消抖时间	ONT 引脚悬空， $\overline{PB}$ 下降沿 →使能断言	●	26	32	41	毫秒
t_{ONT}	额外可调开启时间	C_{ONT} = 1500pF	●	9	11.5	13.5	毫秒
关断定时引脚 (PDT)							
$I_{PDT(PU)}$	PDT 上拉电流	V_{PDT} = 0V	●	–2.4	–3	–3.6	µA
$I_{PDT(PD)}$	PDT 下拉电流	V_{PDT} = 1.3V	●	2.4	3	3.6	µA
t_{DB}，关闭	关闭中断消抖时间	$\overline{PB}$ 下降沿 →$\overline{INT}$ 下降沿	●	26	32	41	毫秒
t_{PD}，最小值	内部 $\overline{PB}$掉电消抖时间（注4）	PDT 引脚悬空， $\overline{PB}$ 下降沿 →使能释放	●	52	64	82	毫秒
t_{PDT}	额外可调节 $\overline{PB}$ 掉电消抖时间	C_{PDT} = 1500pF	●	9	11.5	13.5	毫秒
$t_{\overline{INT}}$，最小值	最小 $\overline{INT}$ 脉冲宽度	$\overline{INT}$ 置位 →$\overline{INT}$ 释放	●	26	32	41	毫秒
$t_{\overline{INT}}$，最大值	最大 $\overline{INT}$ 脉冲宽度	C_{PDT} = 1500pF, $\overline{INT}$ 断言 →$\overline{INT}$ 释放	●	35	43.5	54.5	毫秒
微处理器握手引脚（$\overline{INT}$, $\overline{KILL}$）							
$I_{\overline{INT}}$（漏电流）	$\overline{INT}$ 漏电流	$V_{\overline{INT}}$ = 3V	●			±1	µA
$V_{\overline{INT}}$（低电平输出电压）	$\overline{INT}$ 输出低电压	$I_{\overline{INT}}$ = 3mA	●		0.11	0.4	V
$V_{\overline{KILL}}$（阈值）	$\overline{KILL}$ 输入阈值电压	$\overline{KILL}$ 下降沿	●	0.57	0.6	0.63	V
$V_{\overline{KILL}}$（迟滞）	$\overline{KILL}$ 输入阈值迟滞		●	10	30	50	毫伏
$I_{\overline{KILL}}$（漏电流）	$\overline{KILL}$ 漏电流	$V_{\overline{KILL}}$ = 0.6V	●			±0.1	µA
$t_{\overline{KILL}}$（脉冲宽度）	$\overline{KILL}$ 最小脉冲宽度		●	30			µs
$t_{\overline{KILL}}$(掉电)	$\overline{KILL}$ 传播延迟	$\overline{KILL}$ 下降沿 →使能释放	●			30	µs
$t_{\overline{KILL}}$，开启空白时间	$\overline{KILL}$ 开启空白时间（注3）	$\overline{KILL}$ = 低电平，断言使能 →使能释放	●	400	512	650	毫秒

ELECTRICAL CHARACTERISTICS

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: All currents into pins are positive; all voltages are referenced to GND unless otherwise noted.

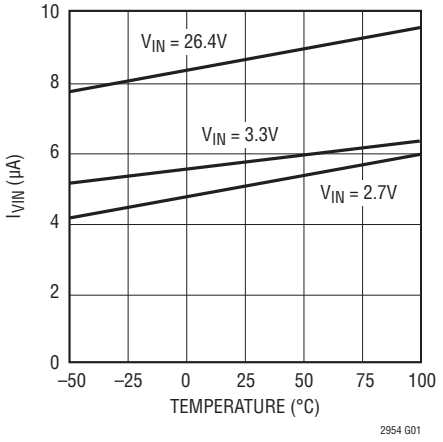
Note 3: The $\overline{KILL}$ turn-on blanking timer period is the waiting period immediately after the enable output is asserted. This blanking time allows sufficient time for the DC/DC converter and the µP to perform power-up tasks. The $\overline{KILL}$ and $\overline{PB}$ inputs are ignored during this period. If $\overline{KILL}$ remains low at the end of this time period, the enable output is released, thus turning off system power. This time delay does not include $t_{DB,ON}$ or t_{ONT}.

Note 4: To manually force an immediate release of the EN/$\overline{EN}$ pin, the pushbutton input must be held low for at least $t_{PD,MIN}$ (internal default power-down timer) + t_{PDT} (adjustable by placing external capacitor at PDT pin).

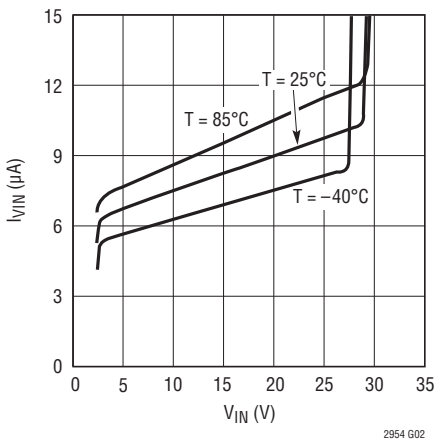
Note 5: The enable lockout time is designed to allow an application to properly power-down such that the next power-up sequence starts from a consistent powered-down configuration. $\overline{PB}$ is ignored during this lockout time. This time delay does not include $t_{DB,ON}$ or t_{ONT}.

TYPICAL PERFORMANCE CHARACTERISTICS

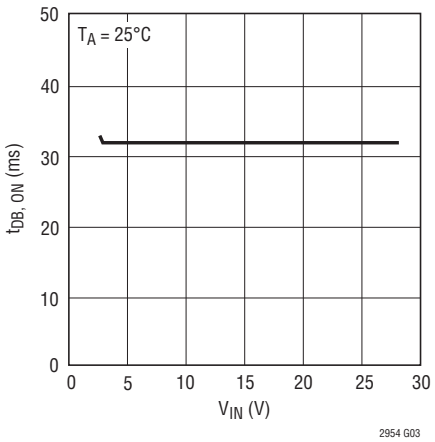
Supply Current vs Temperature



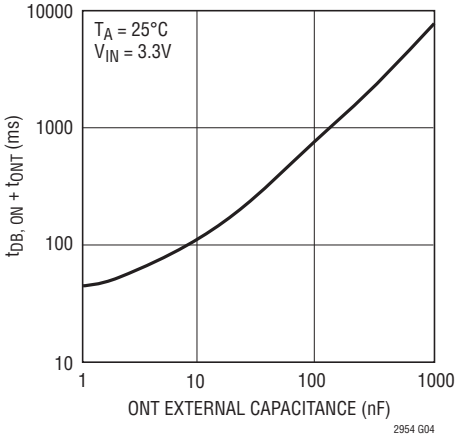
Supply Current vs Supply Voltage



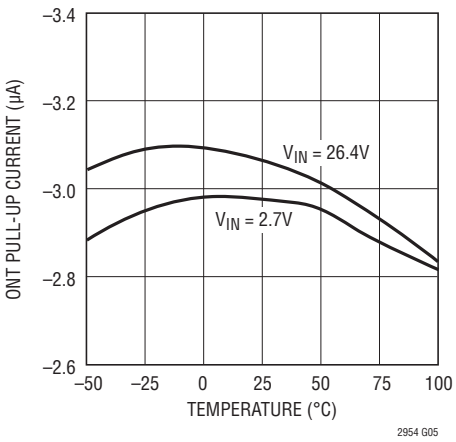
Internal Default Turn-On Debounce Time ($t_{DB,\ ON}$) vs V_{IN}



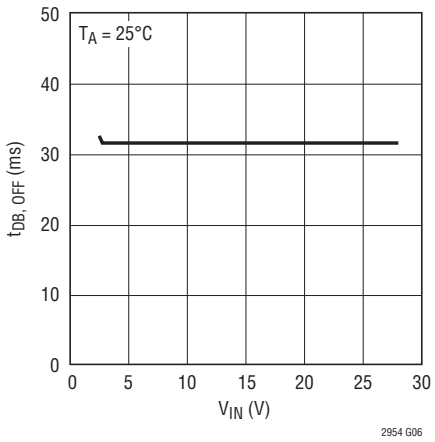
Turn-On Debounce Time ($t_{DB,\ ON}$ + t_{ONT}) vs ONT External Capacitance



ONT Pull-Up Current vs Temperature



Turn-Off Debounce Time ($t_{DB,\ OFF}$) vs V_{IN}



电气特性

注**1**：超过绝对最大额定值范围的应力可能导致器件永久损坏。长时间暴露于任何绝对最大额定值条件可能影响器件的可靠性和寿命。

注**2**：所有流入引脚的电流为正值；除非另有说明，所有电压均以接地（GND）为参考。

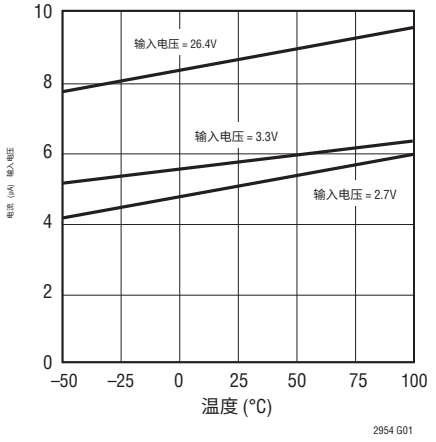
注**3**：$\overline{KILL}$开启消隐定时器周期是使能输出断言后立即的等待时间。该消隐时间为DC/DC转换器和微处理器执行上电任务提供足够时间。在此期间，$\overline{KILL}$和$\overline{PB}$输入被忽略。如果$\overline{KILL}$在此时间结束时仍为低电平，使能输出将被释放，从而关闭系统电源。该时间延迟不包括$t_{DB,ON}$或t_{ONT}。

注**4**：要手动强制立即释放EN/$\overline{EN}$引脚，按键输入必须保持低电平至少$t_{PD,MIN}$（内部默认关断定时器）+ t_{PDT}（通过在PDT引脚接外部电容调整）。

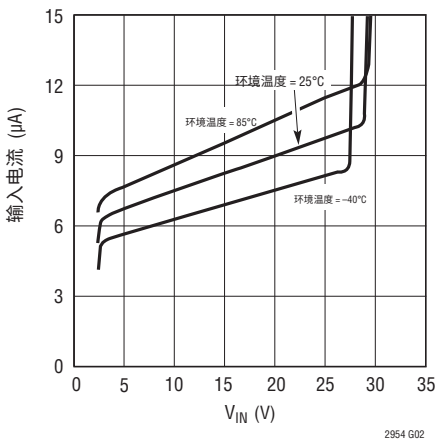
注释 **5**：使能锁定时间设计用于允许应用程序正确断电，以确保下一次上电序列从一致的断电状态开始。按键在此锁定时间内被忽略。此时间延迟不包括 $t_{DB,ON}$或 t_{ONT}。

典型性能特性

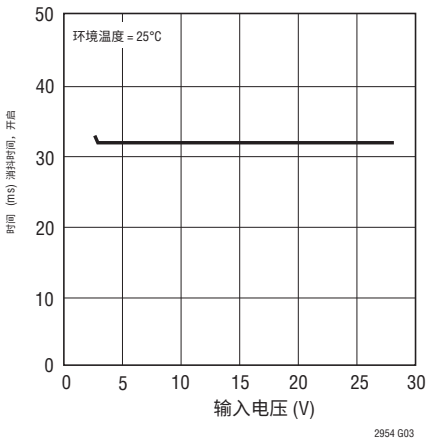
电源电流与温度的关系



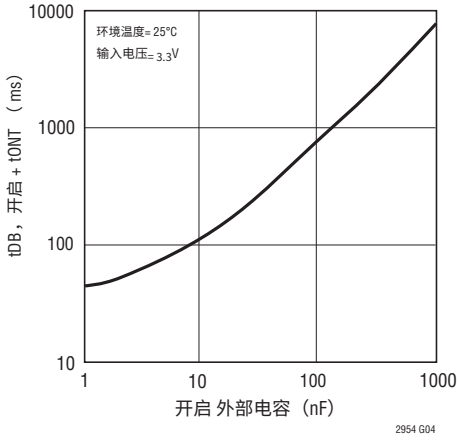
电源电流与电源电压的关系



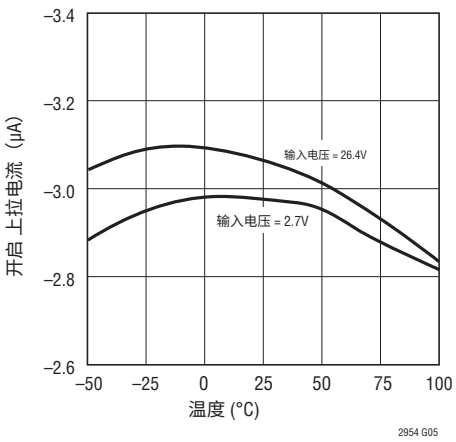
内部默认开启
消抖时间 ($t_{DB, ON}$) 与输入电压的关系



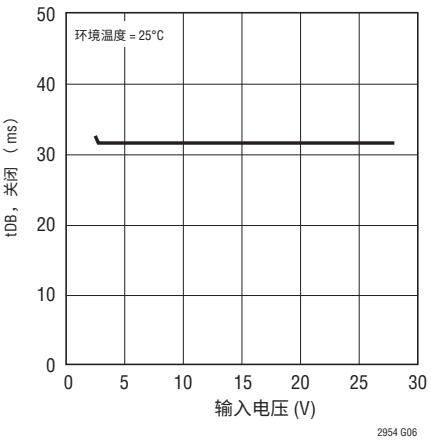
开启消抖时间 ($t_{DB, ON}$ + t_{ONT}) 与 ONT 外部电容的关系



ONT 上拉电流与温度的关系

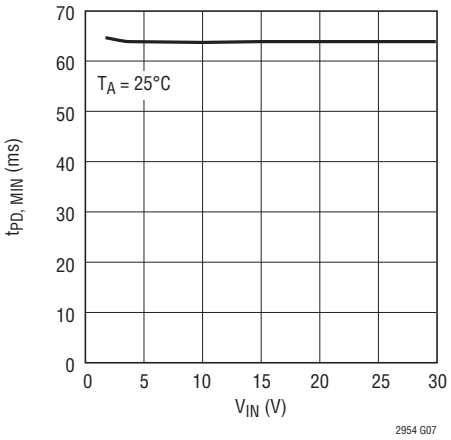


关闭消抖时间 ($t_{DB, OFF}$)
与输入电压的关系



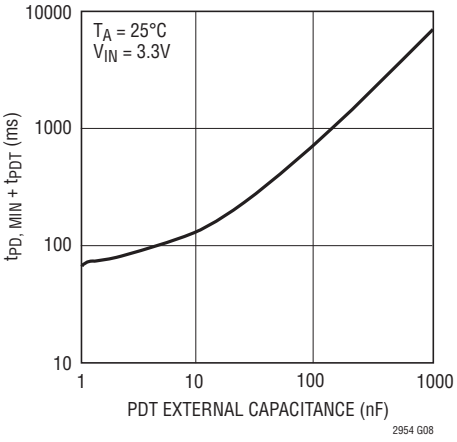
TYPICAL PERFORMANCE CHARACTERISTICS

Internal Default $\overline{PB}$ Power-Down Debounce Time ($t_{PD,MIN}$) vs V_{IN}



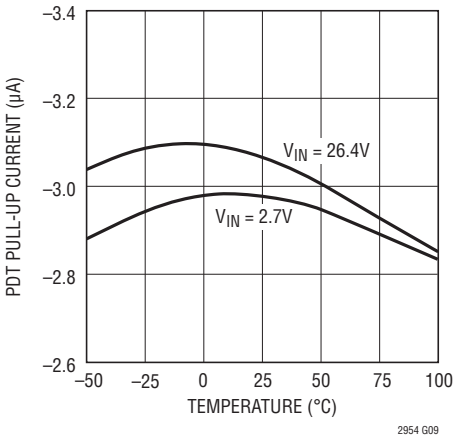
2954 G07

$\overline{PB}$ Power-Down Debounce Time ($t_{PD,MIN}$ + t_{PDT}) vs PDT External Capacitance



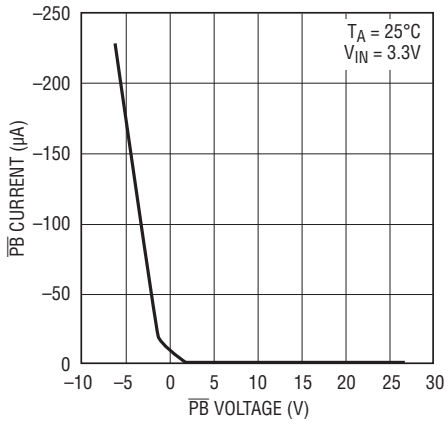
2954 G08

PDT Pull-Up Current vs Temperature



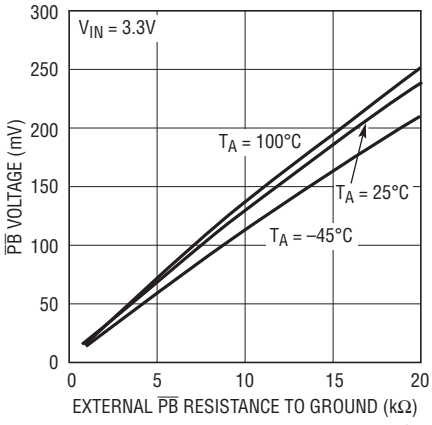
2954 G09

$\overline{PB}$ Current vs $\overline{PB}$ Voltage



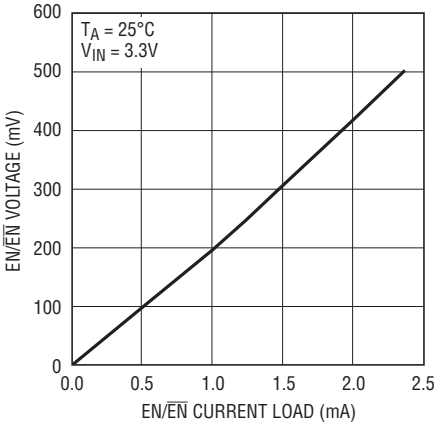
2954 G10

$\overline{PB}$ Voltage vs External $\overline{PB}$ Resistance to Ground



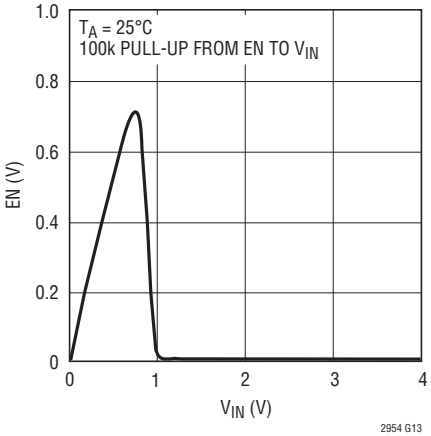
2954 G11

EN/$\overline{EN}$ V_{OL} vs Current Load



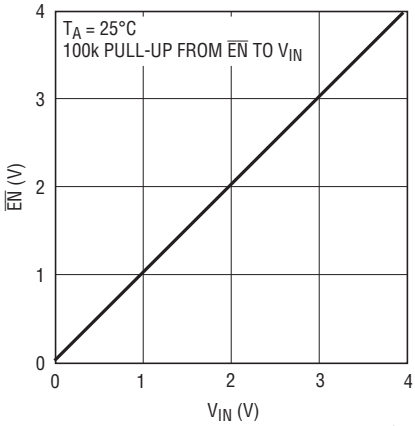
2954 G12

EN (LTC2954-1) Voltage vs V_{IN}



2954 G13

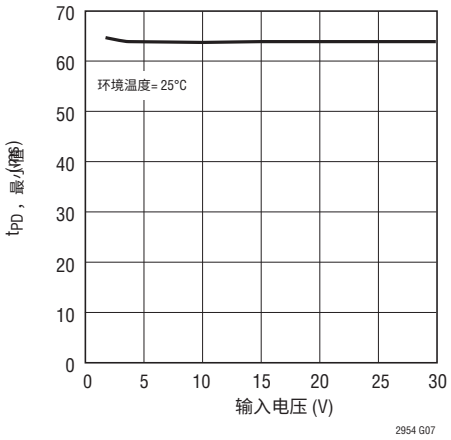
$\overline{EN}$ (LTC2954-2) Voltage vs V_{IN}



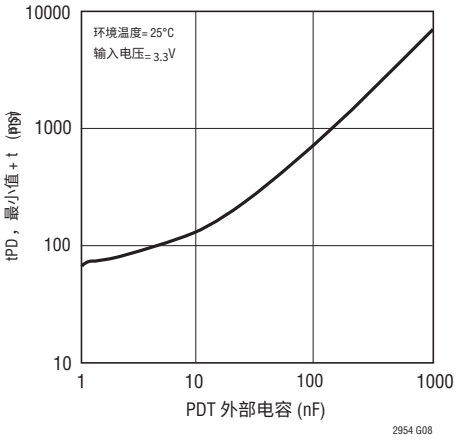
2954 G14

典型性能特性

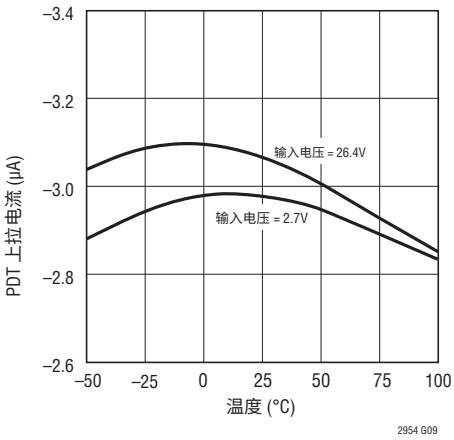
内部默认按键断电
消抖时间（t_{PD}，最小值）与输入电压



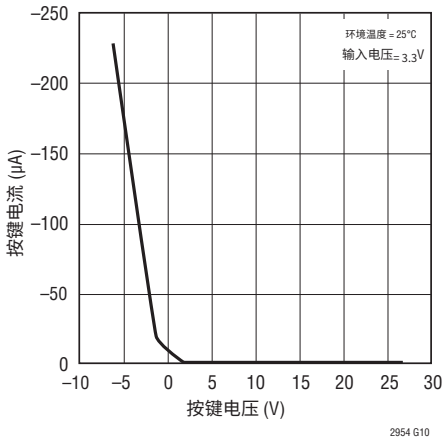
按键断电消抖时间（t_{PD}，最小值+ t_{PDT}）与PDT外部电容



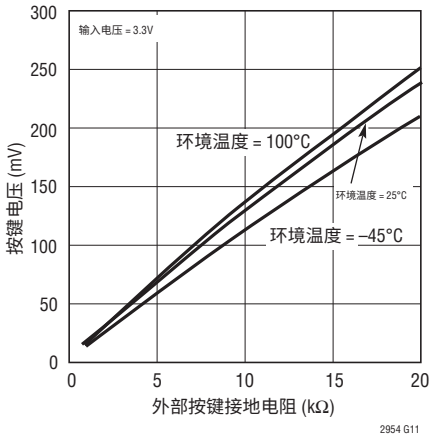
PDT 上拉电流与温度的关系



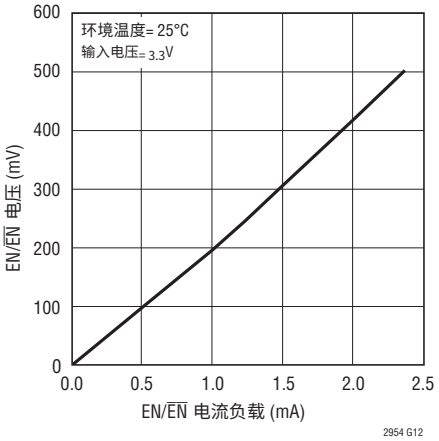
按键电流与按键电压



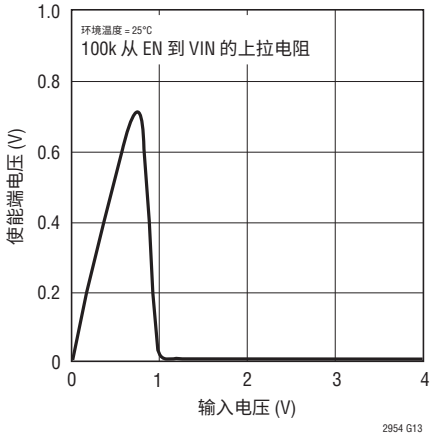
按键电压与外部按键接地电阻



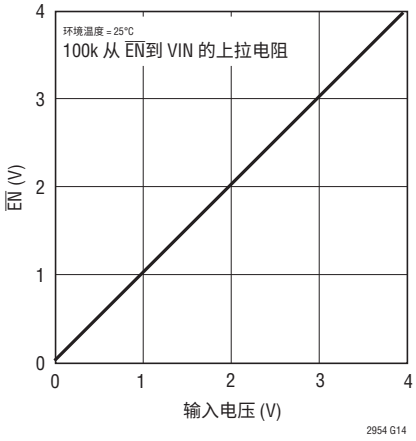
使能/使能低电压与负载电流



使能（LTC2954-1）电压与输入电压



使能（LTC2954-2）电压与输入电压



PIN FUNCTIONS (TSOT-23/DFN)

V_{IN} (Pin 1/Pin 4): Power Supply Input: 2.7V to 26.4V.

$\overline{PB}$ (Pin 2/Pin 3): Pushbutton Input. Connecting $\overline{PB}$ to ground through a momentary switch provides on/off control via the EN/$\overline{EN}$ and $\overline{INT}$ outputs. An internal 100k pull-up resistor connects to an internal 1.9V bias voltage. The rugged $\overline{PB}$ input withstands ±10kV ESD HBM and can be pulled up to 26.4V externally without consuming extra current.

ONT (Pin 3/Pin 2): Turn-On Time Input. Placing an external capacitor to ground determines the additional time (6.4 seconds/µF) the $\overline{PB}$ pin must be held low before the enable output is asserted. Floating this pin results in a default turn on debounce time of 32ms.

GND (Pin 4/Pin 1): Device Ground.

$\overline{INT}$ (Pin 5/Pin 8): Open Drain Interrupt Output. After a pushbutton turn-off event is detected ($t_{DB,OFF}$), the LTC2954 interrupts the system (µP) by asserting the $\overline{INT}$ pin low. The µP would perform power-down and housekeeping tasks and then assert the $\overline{KILL}$ pin low, thus releasing the enable output. The $\overline{INT}$ pulse width is a minimum of 32ms and stays low as long as $\overline{PB}$ is asserted. If $\overline{PB}$ is asserted for longer than $t_{PD,MIN} + t_{PDT}$, the $\overline{INT}$ and EN/$\overline{EN}$ outputs are immediately released.

EN (LTC2954-1, Pin 6/Pin 7): Open Drain Enable Output. This pin is intended to enable system power. EN is asserted high after a valid $\overline{PB}$ turn-on event ($t_{DB,ON} + t_{ONT}$). EN is released low if: a) $\overline{KILL}$ is not driven high (by µP) within 512ms of the initial valid $\overline{PB}$ power turn-on event, b) $\overline{KILL}$ is driven low during normal operation, c) $\overline{PB}$ is pressed and held low ($t_{PD,MIN} + t_{PDT}$) during normal operation. This pin can connect directly to a DC/DC converter shutdown pin that provides an internal pull-up. Otherwise a pull-up resistor to an external supply is required. The operating range for this low leakage pin is 0V to 26.4V.

$\overline{EN}$ (LTC2954-2, Pin 6/Pin 7): Open Drain Enable Bar Output. This pin is intended to enable system power. $\overline{EN}$ is asserted low after a valid $\overline{PB}$ turn-on event ($t_{DB,ON} + t_{ONT}$). $\overline{EN}$ releases high if: a) $\overline{KILL}$ is not driven high (by µP) within 512ms of the initial valid $\overline{PB}$ power turn-on event, b) $\overline{KILL}$ is driven low during normal operation, c) $\overline{PB}$ is pressed and held low ($t_{PD,MIN} + t_{PDT}$) during normal operation. This pin can connect directly to a DC/DC converter shutdown pin that provides an internal pull-up. Otherwise a pull-up resistor to an external supply is required. The operating range of this pin is 0V to 26.4V.

PDT (Pin 7/Pin 6): Power-Down Time Input. A capacitor to ground determines the additional time (6.4 seconds/µF) that the pushbutton must be held low before immediately releasing the EN/$\overline{EN}$ and $\overline{INT}$ outputs. Floating this pin results in a pushbutton power-down time of 64ms.

$\overline{KILL}$ (Pin 8/Pin 5): Kill Input. Forcing $\overline{KILL}$ low releases the enable output. During system turn-on, this pin is blanked by a 512ms internal timer ($t_{\overline{KILL},ON\ BLANK}$) to allow the system to pull $\overline{KILL}$ high. This pin has an accurate 0.6V threshold and can be used as a voltage monitor input. If unused, connect to a low voltage output supply (see Figure 6).

Exposed Pad (Pin 9 DFN Only): Exposed Pad may be left open or connected to device ground.

引脚功能（TSOT-23/DFN）

VIN（引脚1/引脚4）：电源输入，范围为2.7V至26.4V。

$\overline{PB}$（引脚**2**/引脚**3**）：按键开关输入。通过一个瞬时开关将**$\overline{PB}$**接地，可通过EN/$\overline{EN}$和$\overline{INT}$输出实现开/关控制。内部有一个100kΩ上拉电阻连接至内部1.9V偏置电压。
坚固的$\overline{PB}$输入端可承受±10kV $\overline{HBM}$静电放电，且外部可上拉至26.4V而不消耗额外电流。

ONT（引脚**3**/引脚**2**）：开启时间输入。接一个外部电容至地，决定在使能输出断言前，**$\overline{PB}$**引脚必须保持低电平的额外时间（6.4秒/μF）。将此引脚悬空，默认开启消抖时间为**32**ms。

接地（引脚 4/引脚 1）：器件接地。

中断输出（引脚 **5**/引脚 **8**）：开漏中断输出。在检测到按键关闭事件（tDB,OFF）后，$\overline{LTC}$29**5**4通过将**$\overline{INT}$**引脚拉低来中断系统（微处理器）。微处理器将执行断电和维护任务，然后将$\overline{KILL}$引脚拉低，从而释放使能输出。$\overline{INT}$脉冲宽度最短为32ms，并且只要$\overline{PB}$被按下，$\overline{INT}$引脚保持低电平。如果$\overline{PB}$按下时间超过tPD,$\overline{MIN}$+ tPDT，$\overline{INT}$和$\overline{EN}$/$\overline{EN}$输出将立即释放。

使能输出（LTC2954-1，引脚 6/引脚 7）：开漏使能输出。该引脚用于使能系统电源。EN 在有效的 $\overline{PB}$开启事件（$t_{DB,ON}$+ t_{ONT}）后被拉高。如果满足以下任一条件，EN 将被释放为低电平：a）在初始有效PB电源开启事件后512ms内，$\overline{KILL}$未被微处理器拉高；b）$\overline{KILL}$在正常操作期间被拉低；c）PB被按并在正常操作期间保持低电平（$t_{PD,MIN}$+ t_{PDT}）。该引脚可直接连接到具有内部上拉的DC/DC转换器关断引脚。否则，需要通过上拉电阻连接到外部电源。该低漏电引脚的工作电压范围为0V至26.4V。

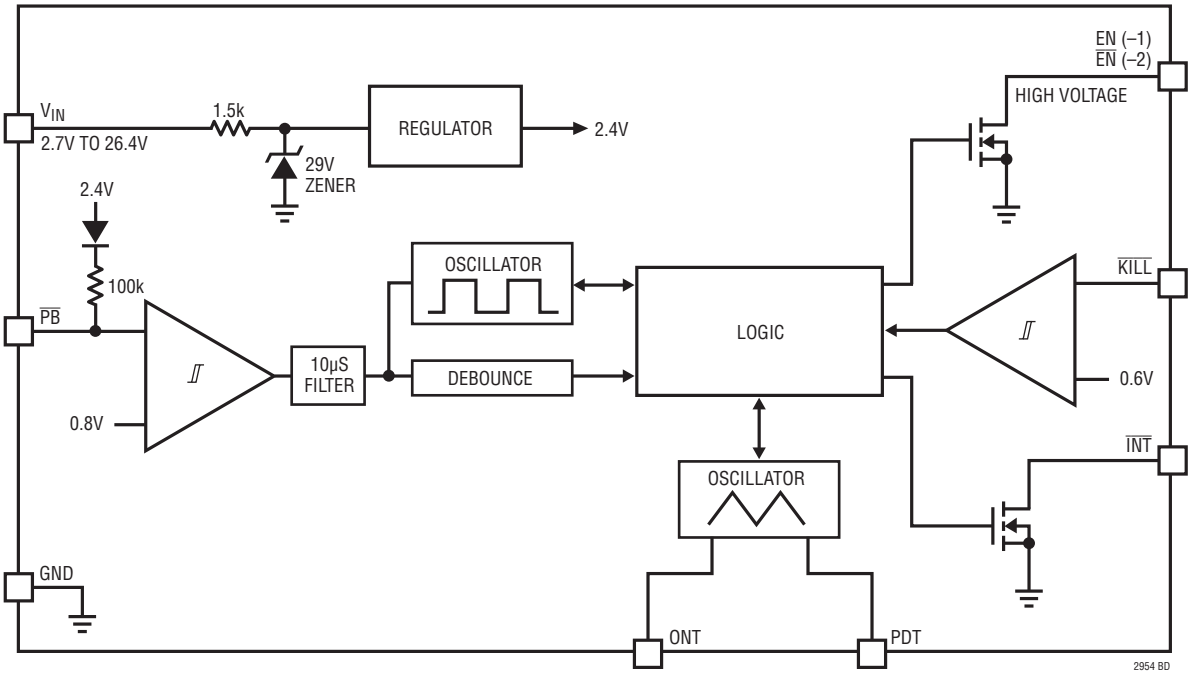
$\overline{EN}$（**LTC2954-2**，引脚 **6**/引脚 **7**）：开漏使能反向输出。该引脚用于使能系统电源。$\overline{EN}$ 在有效的**$\overline{PB}$**开启事件（tD$\overline{B}$,O$\overline{N}$+ t_{ON}**T**）后被拉低。$\overline{EN}$在以下情况下释放高电平：a) $\overline{KILL}$未在初始有效 $\overline{PB}$上电事件后的512ms内由微处理器驱动为高电平，b) $\overline{KILL}$在正常操作期间被驱动为低电平，c) $\overline{PB}$在正常操作期间被按下并保持低电平（t $\overline{PD}$,M$\overline{IN}$+ t $\overline{PDT}$）。该引脚可直接连接到带内部上拉的DC/DC转换器关断引脚，否则需通过上拉电阻连接至外部电源。该引脚的工作电压范围为0V至26.4V。

PDT（引脚7/引脚6）：关断时间输入。接地电容决定按键开关必须保持低电平的额外时间（6.4秒/μF），然后立即释放EN/$\overline{EN}$和 $\overline{INT}$输出。该引脚悬空时，按键开关关断时间为64ms。

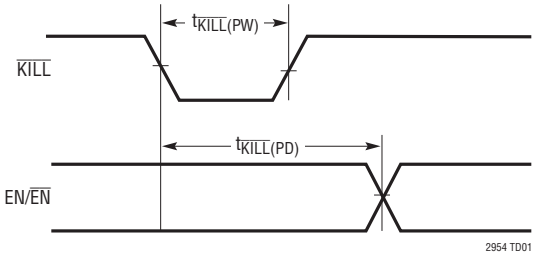
$\overline{KILL}$（引脚8/引脚5）：关断输入。将$\overline{KILL}$强制拉低将释放使能输出。在系统开启期间，该引脚由512ms内部定时器（$t_{\overline{KILL}}$，开启空白）屏蔽，以允许系统将 $\overline{KILL}$拉高。该引脚具有精确的0.6V阈值，可用作电压监测输入。若未使用，请连接至低电压输出电源（见图6）。

裸露焊盘（仅限**9**脚**DFN**）：裸露焊盘可保持悬空或连接至器件接地。

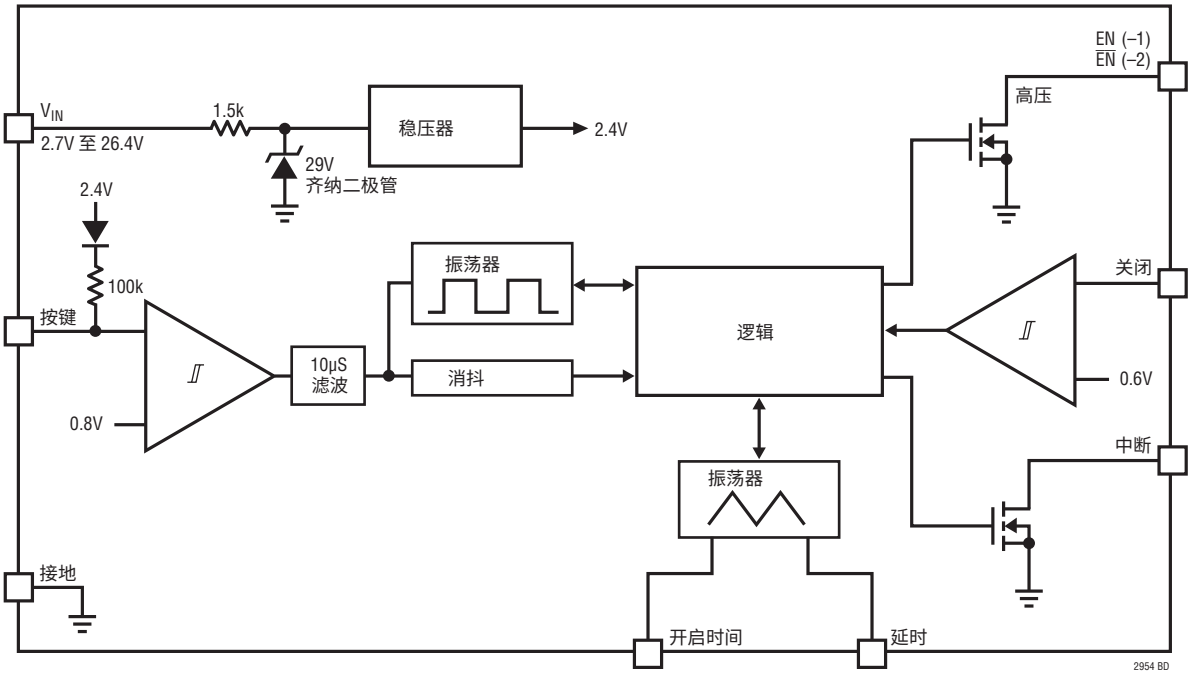
BLOCK DIAGRAM



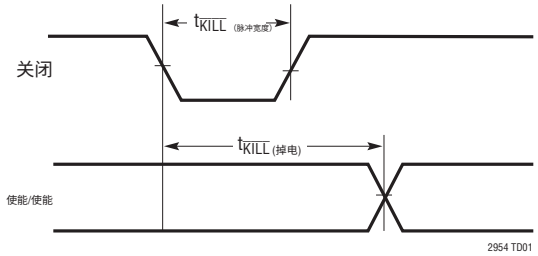
TIMING DIAGRAMS



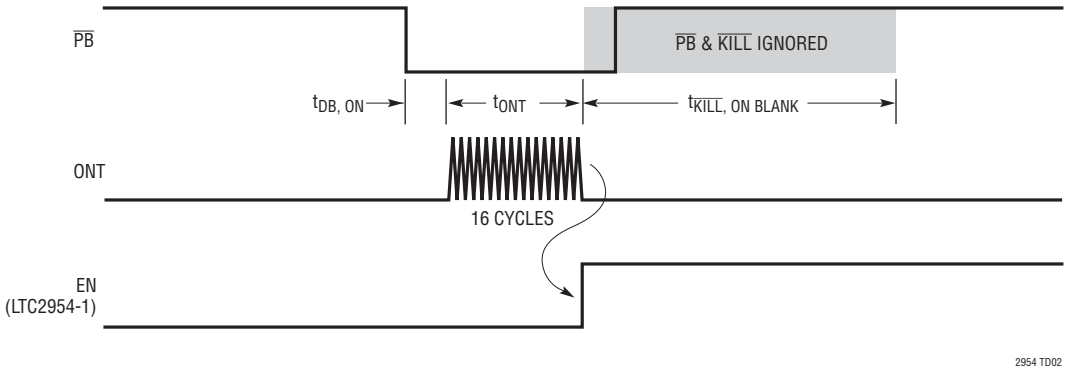
框图


EN (–1)
EN (–2)
高压
VIN
2.7V 至 26.4V
1.5k
稳压器
2.4V
29V
齐纳二极管
2.4V
100k
按键
振荡器
关闭
逻辑
10µS
滤波
消抖
0.6V
0.8V
中断
振荡器
接地
开启时间
延时
2954 BD

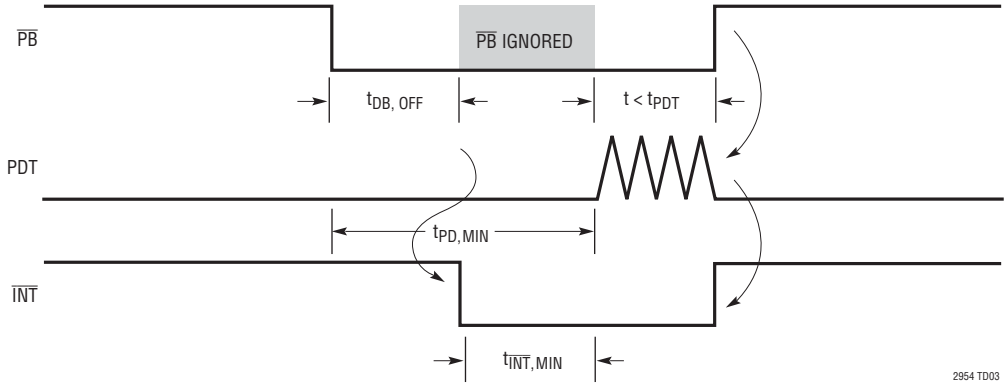
时序图


tKILL (脉冲宽度)
关闭
tKILL (掉电)
使能/使能
2954 TD01

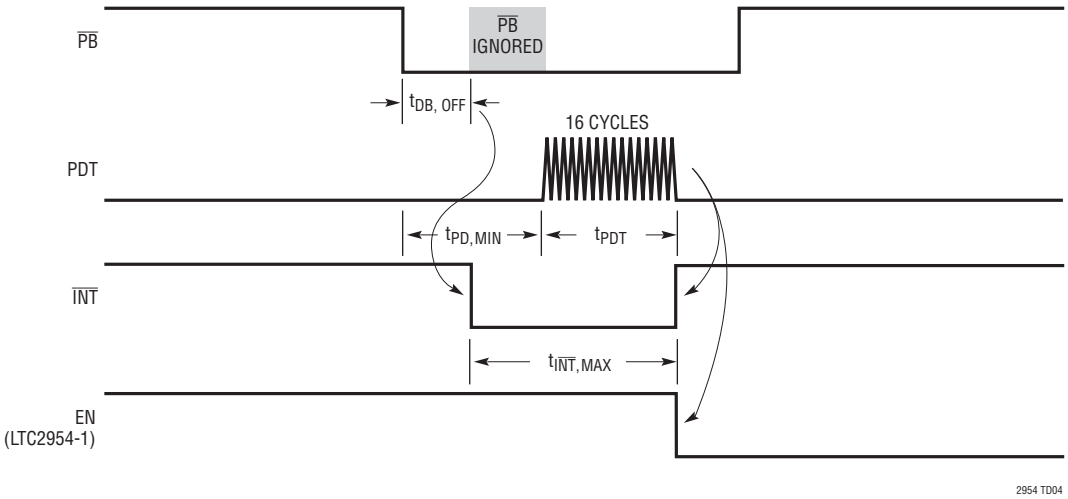
TIMING DIAGRAMS



Power-On Timing

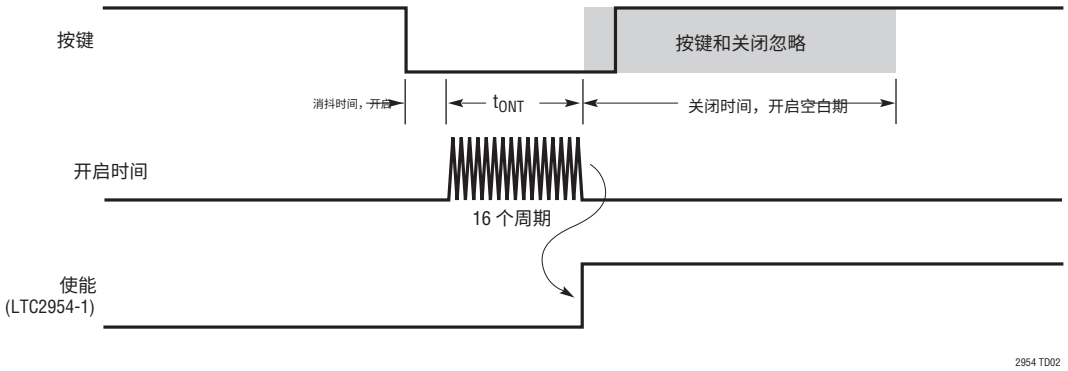


Off Interrupt Timing, $\overline{PB}$ Pressed and Released, Enable Remains Active

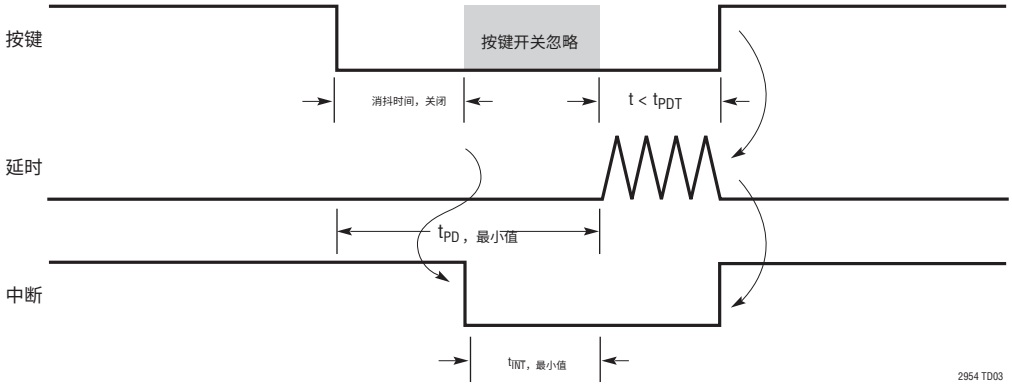


Forced Off, Power-Down Timing, $\overline{PB}$ Pressed and Held Low for t > ($t_{PD,MIN}$ + t_{PDT})

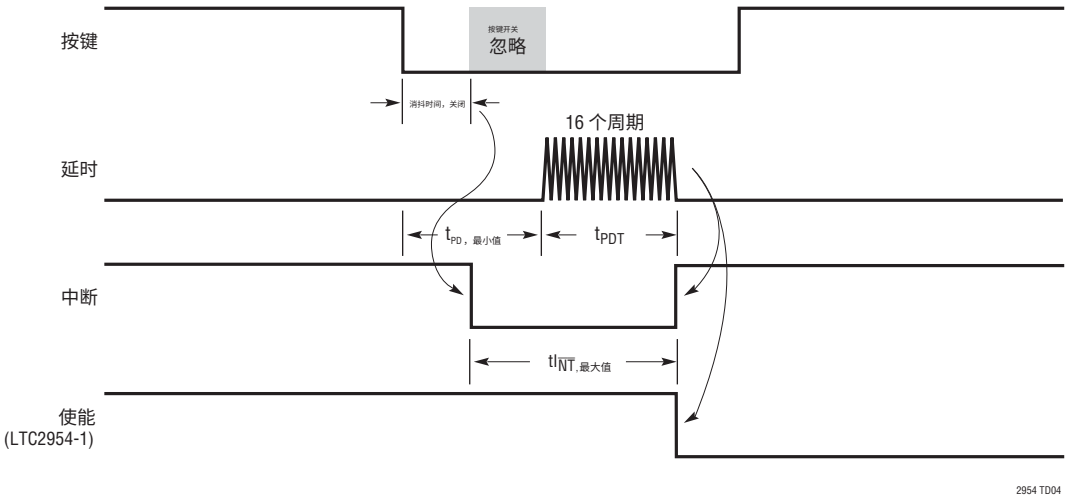
时序图



上电时序



关闭中断时序，按键按下并释放，使能保持激活



强制关闭，断电时序，按键按下并保持低电平，时间 t > (t_{PD}，最小值+ tPDT)

APPLICATIONS INFORMATION

Description

The LTC2954 is a pushbutton on/off controller that provides control of system power via a pushbutton interface. An enable output toggles system power while an interrupt output provides debounced pushbutton status. The interrupt output can be used in menu driven applications to request a system power-down. A power kill input allows a microprocessor or system to release the enable output, effectively powering down the system. Independently adjustable on and off timers allow dependable pushbutton control of the enable output and resistance to accidental toggling of system power.

The length of time the pushbutton input ($\overline{PB}$) must be held low in order to toggle the enable (EN/$\overline{EN}$) output on and off is independently adjustable with external capacitors at the ONT/PDT pins, respectively. During normal operation, the interrupt output ($\overline{INT}$) is asserted 32ms after $\overline{PB}$ goes low. $\overline{INT}$ then tracks $\overline{PB}$ until either $\overline{PB}$ or EN/$\overline{EN}$ is released. See Timing Diagrams on page 8.

The $\overline{KILL}$ input is used to immediately release the enable output. During a normal power-down sequence, $\overline{INT}$ requests a system power-down. The µP then performs its housekeeping tasks and then sets $\overline{KILL}$ low. If the µP fails to set $\overline{KILL}$ low, the user can force a system shutdown by pressing and holding the pushbutton until the PDT timer expires.

Turn On

When power is first applied to the LTC2954, the part initializes the output pins. Any DC/DC converters connected to the EN/$\overline{EN}$ pin will therefore be held off. To assert the enable output, $\overline{PB}$ must be held low for a minimum of 32ms ($t_{DB,ON}$). The LTC2954 provides additional turn-on debounce time (t_{ONT}) via an optional capacitor connected to the ONT pin. The following equation describes the additional time that $\overline{PB}$ must be held low before asserting the enable output. C_{ONT} is the ONT external capacitor (µF):

$$C_{ONT} = 1.56 \times 10^{-4}\ [\mu F/ms] \bullet (t_{ONT} - 1ms)$$

Once the enable output is asserted, any DC/DC converters connected to this pin are turned on. The $\overline{KILL}$ input from the µP is ignored during a succeeding 512ms blanking time ($t_{\overline{KILL},ON\ BLANK}$). This blanking time represents the maximum time required to power up the DC/DC converter and the µP. If $\overline{KILL}$ is not brought high during this 512ms time window, the enable output is released. The assumption is that 512ms is sufficient time for the system to power up.

Turn Off

To initiate a power-down sequence, assert the $\overline{INT}$ output low by pressing the pushbutton for a minimum of 32ms ($t_{DB,OFF}$). The interrupt signal serves as a power-down request to the µP. The µP would then perform power-down and housekeeping tasks and assert $\overline{KILL}$ low when done. This in turn releases the enable output, thus shutting off system power.

Adjustable Power-Down Timer

The LTC2954 provides a failsafe feature that allows the user to turn off system power (via $\overline{PB}$) under system fault conditions. For cases when the µP fails to respond to the interrupt signal, the user can force an immediate power-down by pressing and holding down the pushbutton. The length of time that $\overline{PB}$ must be held low is given by a fixed internal 64ms delay ($t_{PD,MIN}$) plus an adjustable power-down timer delay (t_{PDT}, see Timing Diagrams on page 8). The adjustable delay is set by placing an optional external capacitor on the PDT pin. Use the following equation to calculate the capacitance for the desired delay. C_{PDT} is the PDT external capacitor (µF):

$$C_{PDT} = 1.56 \times 10^{-4}\ [\mu F/ms] \bullet (t_{PDT} - 1ms)$$

Simplified Power On/Off Sequence

Figure 1 shows a simplified LTC2954-1 power-on and power-off sequence. A high to low transition on $\overline{PB}$ (t_1) initiates the power on sequence. In order to assert the enable output, the $\overline{PB}$ pin must stay low continuously ($\overline{PB}$ high resets timers) for a time controlled by the default 32ms and the external ONT capacitor (t_2–t_1). Once EN goes high (t_2), an internal 512ms blanking timer is started. This blanking timer is designed to give sufficient time for the DC/DC converter to reach its final voltage, and to allow the µP enough time to perform power-on tasks.

The $\overline{KILL}$ pin must be pulled high within 512ms of the EN pin going high. Failure to do so results in the EN pin going

应用信息

描述

LTC2954 是一款按键开关开/关控制器，通过按键开关接口实现系统电源控制。使能输出切换系统电源，中断输出提供消抖后的按键开关状态。中断输出可用于菜单驱动应用中请求系统断电。电源关闭输入允许微处理器或系统释放使能输出，从而有效关闭系统电源。独立可调的开启和关闭定时器确保使能输出的可靠按键控制，并防止系统电源意外切换。

按键开关输入（$\overline{PB}$）必须保持低电平的时间长度，以切换使能（EN/$\overline{EN}$）输出的开启和关闭，分别可通过外部电容在 ONT/PDT 引脚独立调节。在正常操作期间，中断输出（$\overline{INT}$）在 $\overline{PB}$ 变低后 32ms 断言，随后 $\overline{INT}$跟踪 $\overline{PB}$，直到 $\overline{PB}$或 EN/$\overline{EN}$释放。详见第 8 页的时序图。

KILL输入用于立即释放使能输出。在正常断电序列中，INT请求系统断电。随后μP执行其维护任务，并将KILL置低。如果μP未能将KILL置低，用户可通过按住按键开关直到PDT定时器到期来强制系统关机。

开启

当电源首次加到LTC2954时，芯片初始化输出引脚。因此，任何连接到EN/$\overline{EN}$引脚的DC/DC转换器将被保持关闭。要断言使能输出，$\overline{PB}$必须保持低电平至少32ms（$t_{DB，ON}$）。LTC2954通过连接到ONT引脚的可选电容提供额外的开启消抖时间（t_{ONT}）。下式描述了在断言使能输出之前，$\overline{PB}$必须保持低电平的额外时间。C_{ONT}为 ONT 外部电容（μF）：

$$C_{ONT} = 1.56 \times 10^{-4} [\mu F/ms] \bullet (t_{ONT} - 1ms)$$

一旦使能输出被断言，连接到该引脚的所有 DC/DC 转换器将被开启。来自微处理器的 $\overline{KILL}$输入在随后的 512ms 抑制时间（$t_{\overline{KILL},ON\ BLANK}$）内被忽略。该抑制时间表示 DC/DC 转换器和微处理器上电所需的最大时间。如果在此 512ms 时间窗口内 $\overline{KILL}$未被拉高，使能输出将被释放。假设 512ms 是系统上电所需的足够时间。

关闭

要启动关机序列，按下按键开关至少 32ms（$t_{DB,OFF}$）以将INT输出拉低。中断信号作为向微处理器发出的关机请求。微处理器随后将执行断电和清理任务，并在完成后将 $\overline{KILL}$信号拉低。

这将释放使能输出，从而关闭系统电源。

可调断电定时器

LTC2954 提供故障安全功能，允许用户在系统故障条件下通过 $\overline{PB}$关闭系统电源。当微处理器未响应中断信号时，用户可通过按住按键开关强制立即断电。按键开关必须保持低电平的时间由固定内部64ms延迟（$t_{\overline{PD},MIN}$）加上可调断电定时器延迟（t_{PDT}，见第8页时序图）决定。

可调延迟通过在PDT引脚接入外部电容设置。使用以下公式计算所需延迟的电容值。C_{PDT}为PDT引脚外部电容（μF）：

$$C_{PDT} = 1.56 \times 10^{-4} [\mu F/ms] \bullet (t_{PDT} - 1ms)$$

简化的开启/关闭电源序列

图1显示了简化的LTC2954-1开启和关闭电源序列。$\overline{PB}$引脚上的高到低跳变（t1）启动开启电源序列。为了使能输出有效，$\overline{PB}$引脚必须持续保持低电平（$\overline{PB}$高电平会重置定时器），时间由默认的32ms和外部ONT电容控制（t2–t1）。一旦$_{EN}$

在t2时变为高电平，内部512ms空白定时器开始计时。该空白定时器设计用于给予DC/DC转换器足够时间达到最终电压，并允许微处理器有足够时间执行开机任务。

$\overline{KILL}$引脚必须在EN引脚变高后的512ms内被拉高。未能如此操作将导致EN引脚进入

APPLICATIONS INFORMATION

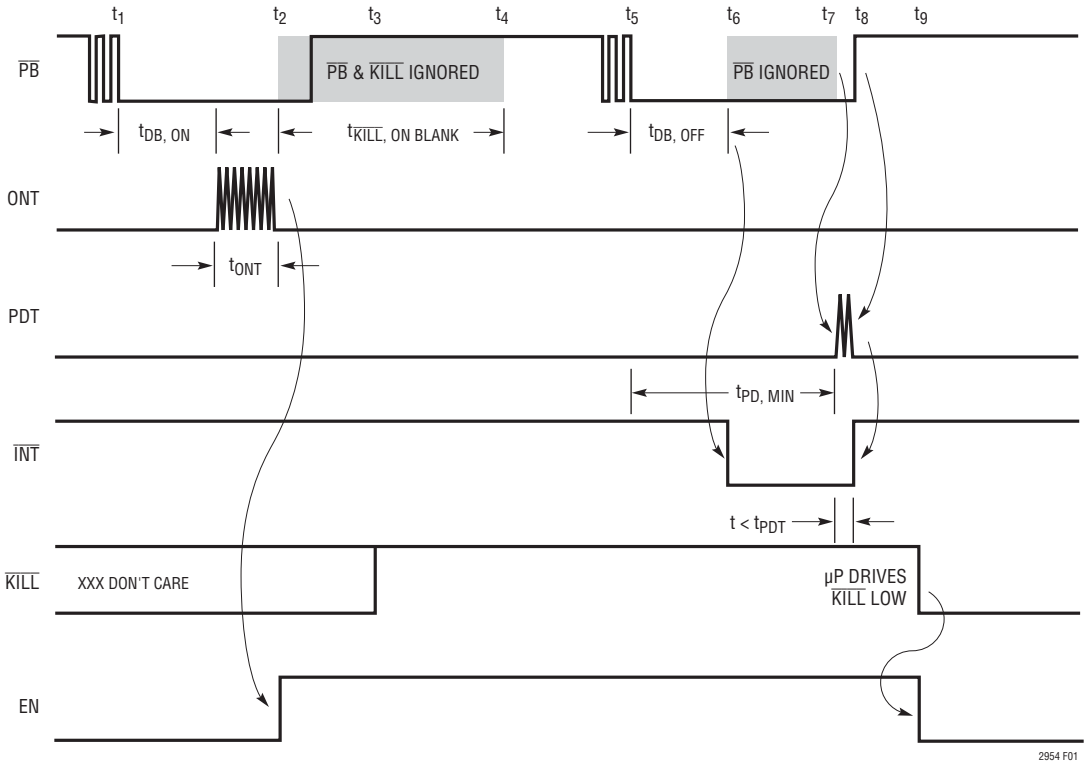


Figure 1. Simplified Power On/Off Sequence for LTC2954-1. µP Asserts $\overline{\text{KILL}}$ After an Interrupt

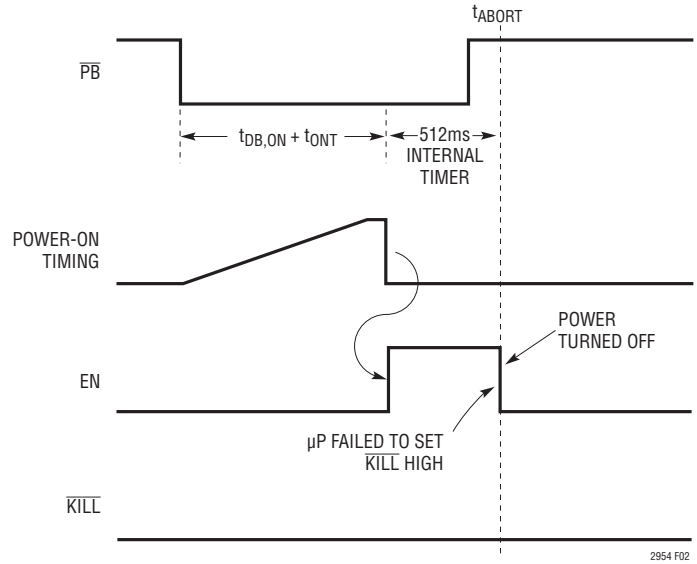


Figure 2. $\overline{\text{KILL}}$ Remaining Low Aborts Power-On Sequence for LTC2954-1

应用信息

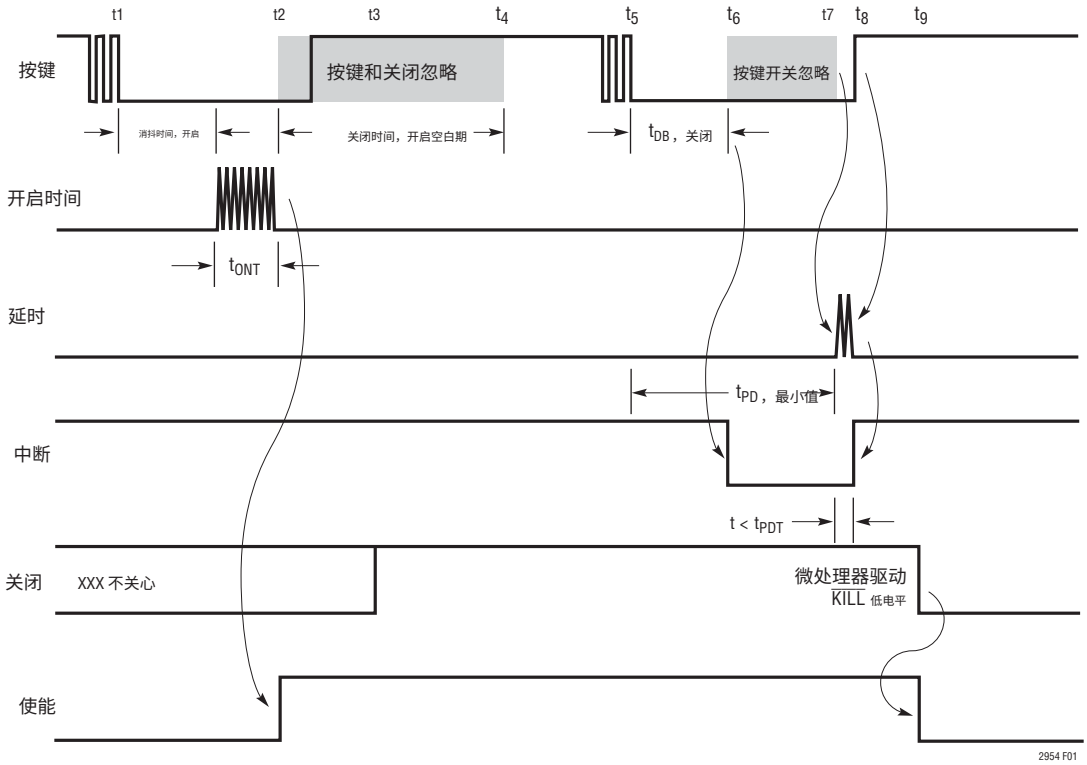


图1. LTC2954-1简化的开/关电源序列。微处理器在中断后断言 $\overline{KILL}$

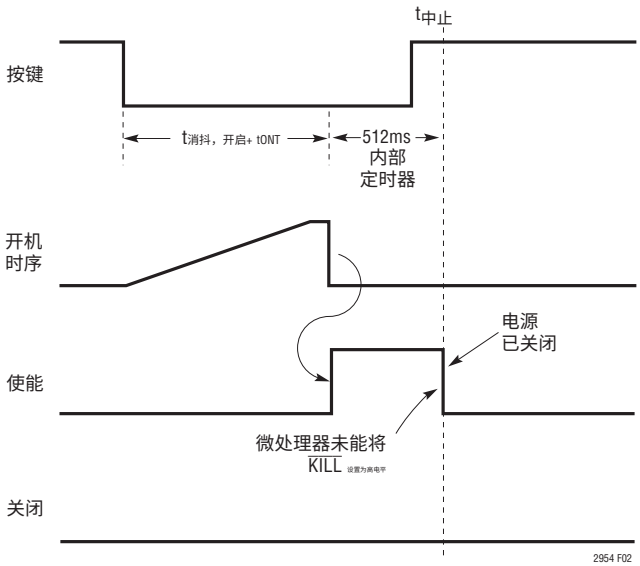


图2. LTC2954-1的$\overline{KILL}$保持低电平中止开机序列

APPLICATIONS INFORMATION

low 512ms after it went high. Note that the LTC2954 does not sample $\overline{KILL}$ and $\overline{PB}$ until after the 512ms internal timer has expired. The reason $\overline{PB}$ is ignored is to ensure that the system is not forced off while powering on. Once the 512ms timer expires (t_4), the release of the $\overline{PB}$ pin is then debounced with an internal 32ms timer. The system has now properly powered on and the LTC2954 monitors $\overline{PB}$ and $\overline{KILL}$ for a turn-off command while consuming only 6µA of supply current.

A high to low transition on $\overline{PB}$ (t_5) starts the power-off sequence debounce timer. In order to assert the interrupt output ($\overline{INT}$), $\overline{PB}$ must stay low continuously ($\overline{PB}$ high resets debounce timer) for 32ms (t_6–t_5). At the completion of the power-down debounce timer (t_6), an internal interrupt timer keeps the interrupt output low for at least 32ms, even if $\overline{PB}$ is released between t_6 and t_7. If $\overline{PB}$ is low at the end of this 32ms internal timer (t_7), the external adjustable power-down timer is started. The capacitor placed at the PDT pin will determine the time period of this timer. If the pushbutton is released prior to 16 cycles of the PDT pin, the interrupt output will go high (t_8). Note that the enable output is not directly changed by this interrupt pulse. The function of the interrupt signal is to initiate a software shutdown. At t_9, the µP has performed its power-down functions and asserted the $\overline{KILL}$ input low. This releases the enable output, which in turn shuts down system power. Note that if the pushbutton is held long enough to count 16 cycles at the PDT pin, the enable pin would be released immediately after the 16th cycle. The system is now in its reset state where the LTC2954 is in low power mode (6µA) and $\overline{PB}$ is monitored for a high to low transition.

Aborted Power-On Sequence

The power-on sequence is aborted when the $\overline{KILL}$ remains low at the end of the 512ms blanking time. Figure 2 is a simplified version of an aborted power-on sequence. At time t_{ABORT}, since $\overline{KILL}$ is still low, EN pulls low (thus turning off the DC/DC converter).

µP Turns Off Power During Normal Operation

Once the system has powered on and is operating normally, the µP can turn off power by setting $\overline{KILL}$ low, as shown in (Figure 3). At time $t_{\overline{KILL}}$, $\overline{KILL}$ is set low by the µP. This immediately pulls EN low, thus turning off the DC/DC converter.

DC/DC Turn Off Blanking

When the DC/DC converter is turned off, it can take a significant amount of time for its output to decay to ground. It is desirable to wait until the output of the DC/DC converter is near ground before allowing the user (via $\overline{PB}$) to restart the converter. This condition guarantees that the µP has always powered down completely before it is restarted.

Figure 4 shows the µP turning power off. After a low on $\overline{KILL}$ releases enable, the internal 256ms timer ignores the $\overline{PB}$ pin. This is shown as $t_{EN/\overline{EN},\ LOCKOUT}$ in (Figure 4).

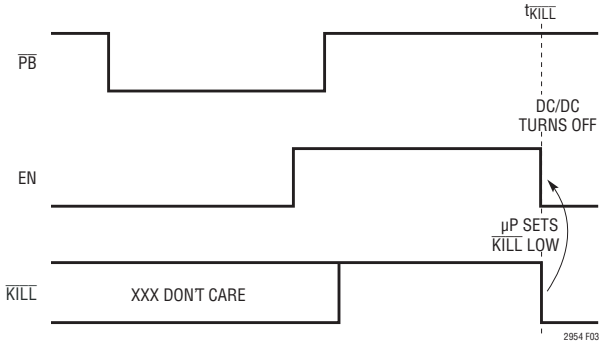


Figure 3. µP Turns Off Power (LTC2954-1)

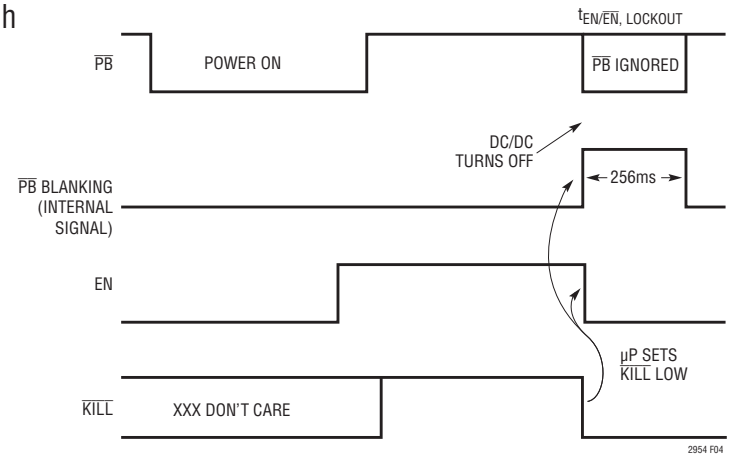


Figure 4. DC/DC Turn-Off Blanking (LTC2954-1)

应用信息

在其变为高电平后512ms的低电平。注意，LTC2954在512ms内部定时器到期之前，不会采样$\overline{KILL}$和$\overline{PB}$信号。忽略$\overline{PB}$的原因是确保系统在上电过程中不会被强制关闭。512ms定时器到期（t4）后，$\overline{PB}$引脚释放信号通过内部32ms定时器进行消抖。系统现已正确开启，LTC2954 监控$\overline{PB}$和$\overline{KILL}$以检测关机命令，同时仅消耗6μA的供电电流。

在$\overline{PB}$上的高到低跳变（t_5）启动关机序列消抖定时器。为了断言中断输出（$\overline{INT}$），$\overline{PB}$必须持续保持低电平（$\overline{PB}$高电平将重置消抖定时器）32ms（t_6–t_5）。在关机消抖定时器完成时（t_6），内部中断定时器将使中断输出保持低电平至少32ms，即使$\overline{PB}$在t_6和t_7之间被释放。如果PB在该32ms内部定时器结束时（t_7）仍为低电平，则启动外部可调关机定时器。连接于PDT引脚的电容将决定该定时器的时间周期。如果按键开关在PDT引脚完成16个周期之前被释放，中断输出将变为高电平（t_8）。请注意，使能输出不会被该中断脉冲直接改变。中断信号的功能是启动软件关机。在 t_9 时，微处理器已执行断电功能并将KILL输入拉低。此操作释放使能输出，进而关闭系统电源。请注意，如果按键开关保持按下时间足够长以在 PDT 引脚计数到16个周期，使能引脚将在第16个周期后立即释放。

系统现处于复位状态，LTC2954 处于低功耗模式（6μA），并监测 $\overline{PB}$的高到低跳变。

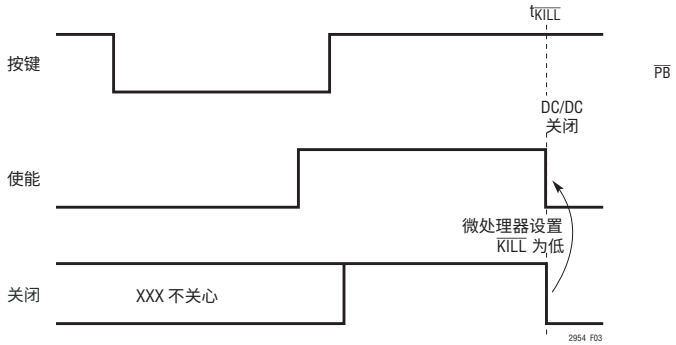


图3。 微处理器关闭电源（LTC2954-1）

中止上电序列

当$\overline{KILL}$在512ms消隐时间结束时仍保持低电平，上电序列将被中止。图2为中止上电序列的简化示意图。在时间t_{ABORT}，由于 $\overline{KILL}$仍为低电平，EN被拉低（从而关闭DC/DC转换器）。

微处理器在正常运行期间关闭电源

系统上电并正常运行后，微处理器可通过将 $\overline{KILL}$置低来关闭电源，如图3所示。在时间$t_{\overline{KILL}}$，微处理器将 $\overline{KILL}$置低。这会立即将EN拉低，从而关闭DC/DC转换器。

DC/DC关闭消隐

当DC/DC转换器关闭时，其输出衰减至地电平可能需要较长时间。理想情况下，应等待DC/DC转换器的输出接近地电位后，才允许用户（通过$\overline{PB}$）重新启动转换器。此条件保证微处理器在重新启动前始终已完全断电。

图4显示了微处理器关闭电源的过程。在$\overline{KILL}$引脚低电平释放使能后，内部256ms定时器忽略$\overline{PB}$引脚。如图4中所示，标记为$t_{EN/\overline{EN}}$，$\overline{LOC}\overline{K}_{OUT}$。

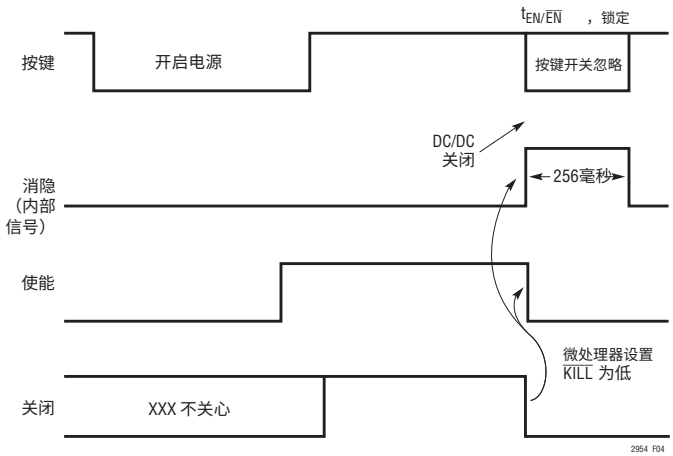


图4。 DC/DC关闭消隐（LTC2954-1）

APPLICATIONS INFORMATION

LTC2954-1, LTC2954-2 Versions

The LTC2954-1 (high true EN) and LTC2954-2 (low true $\overline{EN}$) differ only by the polarity of the high voltage (33V ABS MAX), enable pin. The LTC2954-1 EN pin is a low leakage high true open drain output designed to drive the shutdown pin of DC/DC converters. The LTC2954-2 is a low leakage, low true open drain enable output designed to drive the gate of an external PFET. The LTC2954-2 provides a user manual power path control.

High Voltage Pins

The V_{IN}, $\overline{PB}$ and EN/$\overline{EN}$ pins can operate at voltages up to 26.4V. $\overline{PB}$ can, additionally, operate below ground (–6V) without latching up the device. $\overline{PB}$ has an ESD HBM rating of ±10kV. If the pushbutton switch connected to $\overline{PB}$ exhibits high leakage current, then an external pull-up resistor to V_{IN} is recommended. Furthermore, if the pushbutton switch is physically located far from the LTC2954 $\overline{PB}$ pin, parasitic capacitances may couple onto the high impedance $\overline{PB}$ input. Additionally, parasitic series inductance may cause unpredictable ringing at the $\overline{PB}$ pin. Placing a 5.1k resistor from the $\overline{PB}$ pin to the pushbutton switch would mitigate parasitic inductance problems. Placing a 0.1µF capacitor on the $\overline{PB}$ pin would lessen the impact of parasitic capacitive coupling.

TYPICAL APPLICATIONS

Voltage Monitoring with $\overline{KILL}$ Input

The $\overline{KILL}$ pin can be used as a voltage monitor. Figure 5 shows an application where the $\overline{KILL}$ pin has a dual function. It is driven by a low leakage open drain output of the µP. It is also connected to a resistive divider that monitors battery voltage (V_{IN}). When the battery voltage falls below the set value, the voltage at the $\overline{KILL}$ pin falls below 0.6V and the EN pin is quickly pulled low. Note that the resistor values should be as large as possible, but small enough to keep leakage currents from tripping the 0.6V $\overline{KILL}$ comparator.

The DC/DC converter shown has an internal pull-up current on its $\overline{SHDN}$ pin. A pull-up resistor on EN is thus not needed.

Operation Without µP

Figure 6 shows how to connect the $\overline{KILL}$ pin when there is no circuitry available to drive it. The minimum pulse

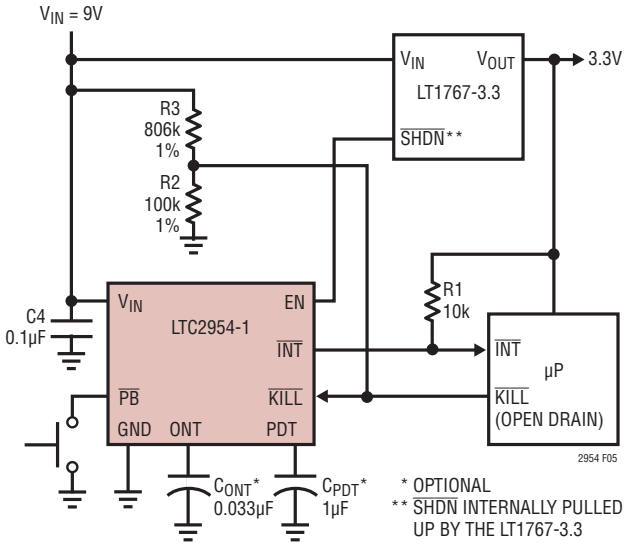


Figure 5. Input Voltage Monitoring with $\overline{KILL}$ Input

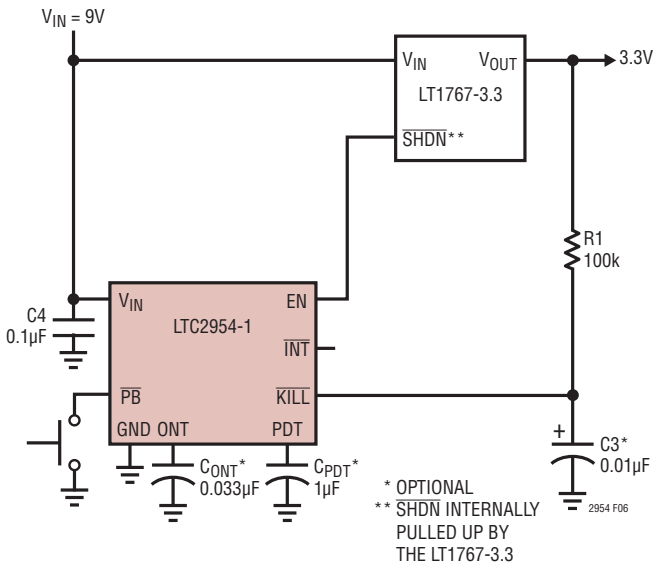


Figure 6. No µP Application

应用信息

LTC2954-1，LTC2954-2 版本

LTC2954-1（高电平有效使能）和LTC2954-2（低电平有效使能）的区别仅在于高电压（33V ABS MAX）使能引脚的极性。LTC2954-1的EN引脚为低漏电高电平有效开漏输出，设计用于驱动DC/DC转换器的关断引脚。LTC2954-2为低漏电、低电平有效开漏使能输出，设计用于驱动外部PFET的栅极。LTC2954-2提供用户手动电源路径控制。

高电压引脚

VIN、$\overline{PB}$和EN/$\overline{EN}$引脚可承受高达26.4V的电压。$\overline{PB}$引脚还可在低于地电位（–6V）下工作，且不会导致器件锁定。PB引脚的ESD HBM等级为±10kV。 如果连接到PB的按键开关表现出高漏电流，建议外接一个上拉电阻至VIN。 此外，如果按键开关物理位置远离LTC2954的PB引脚，寄生电容可能会耦合到高阻抗的PB输入端。另外，寄生串联电感可能导致PB引脚出现不可预测的振铃。在PB引脚与按键开关之间放置一个5.1k电阻器可以缓解寄生电感问题。在PB引脚上放置一个0.1µF电容器可以减轻寄生电容耦合的影响。

典型应用

带 $\overline{KILL}$输入的电压监测 $\overline{KILL}$引

脚可用作电压监测。图5显示了$\overline{KILL}$引脚具有双重功能的应用。它由微处理器的低漏电开漏输出驱动。它还连接到一个电阻分压器，用于监测电池电压（V_{IN}）。 当电池电压低于设定值时，$\overline{KILL}$引脚电压降至0.6V以下，EN引脚迅速被拉低。请注意，电阻值应尽可能大，但不能过小。足以防止漏电流触发0.6V $\overline{KILL}$比较器。

所示的DC/DC转换器在其$\overline{SHDN}$引脚上具有内部上拉电流，因此EN引脚不需要上拉电阻。

无微处理器操作

图6显示了当没有可用电路驱动$\overline{KILL}$引脚时的连接方式。检测到的最小脉冲

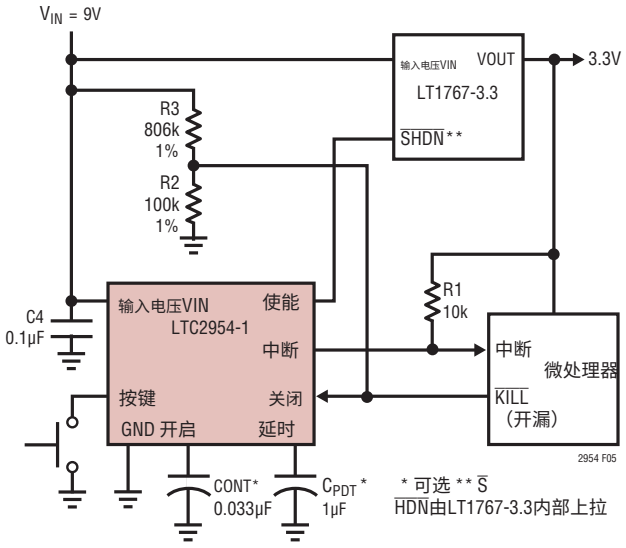


图5。 带 $\overline{KILL}$输入的输入电压监测

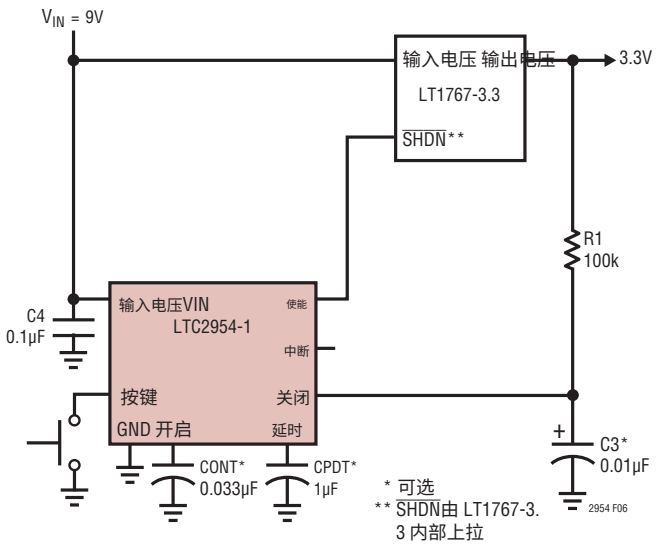


图6。无微处理器应用

TYPICAL APPLICATIONS

width detected is 30µs. If there are glitches on the resistor pull-up voltage that are wider than 30µs and transition below 0.6V, then an appropriate bypass capacitor should be connected to the $\overline{KILL}$ pin. The optional C_{PDT} external capacitor extends the length of time (beyond 64ms) that the $\overline{PB}$ input must be held low before releasing the enable output.

High Voltage PowerPath Switching

The high voltage $\overline{EN}$ open drain output of the LTC2954-2 is designed to switch on/off an external power PFET. This allows a user to connect/disconnect a power supply (or battery) to its load by toggling the $\overline{PB}$ pin. Figure 7 shows the LTC2954-2 controlling a two cell Li-Ion battery application. The $\overline{KILL}$ pin is connected to the output of the PFET through a resistive divider. The $\overline{KILL}$ pin serves as a voltage monitor. When V_{OUT} drops below 6V, causing a $\overline{KILL}$ voltage below $V_{\overline{KILL}(TH)}$, the $\overline{EN}$ pin becomes an open circuit 30µs later. Since the PDT pin is open-circuited, the power-down debounce time defaults to 64ms.

$\overline{PB}$ Pin in a Noisy Environment

The rugged $\overline{PB}$ pin is designed to operate in noisy environments. Transients below ground (>–6V) and above V_{IN} (<33V) will not damage the rugged $\overline{PB}$ pin. Additionally, the $\overline{PB}$ pin can withstand ESD HBM strikes up to ±10kV.

In order to keep external noise from coupling inside the LTC2954, place an R-C network close to the $\overline{PB}$ pin. A 5.1k resistor and a 0.1µF capacitor should suffice for most noisy applications (see Figure 8).

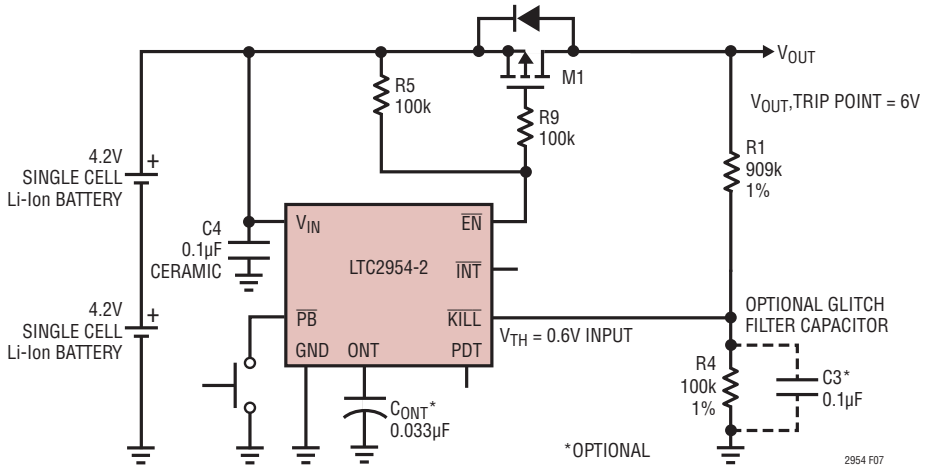


Figure 7. PowerPath Control with 6V Undervoltage Detect

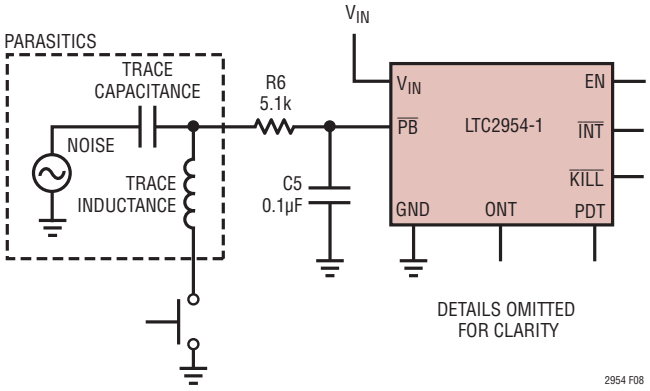


Figure 8. Noisy $\overline{PB}$ Trace

典型应用

宽度为30μs。 如果上拉电阻电压上存在宽度超过30μs且低于0.6V的毛刺，则应在 $\overline{KILL}$引脚连接适当的旁路电容。可选的C_{PDT}外部电容延长了 $\overline{PB}$ 输入保持低电平的时间（超过64ms），然后释放使能输出。

高压电源路径切换 LTC2954-2

的高压 $\overline{EN}$开漏输出设计用于切换外部电源**P**FET的开启/关闭。用户可通过切换 $\overline{PB}$引脚来连接或断开电源（或电池）与负载的连接。图7展示了LTC2954-2控制两节锂离子电池应用的示意图。$\overline{KILL}$引脚连接至

PFET 通过分压器。$\overline{KILL}$ 引脚用作电压监测。当 V_{OUT} 下降至低于 6V，导致 $\overline{KILL}$ 电压低于 $V\overline{KILL}_{(TH)}$ 时，$\overline{EN}$ 引脚在 30μs 后变为开路。由于 PDT 引脚开路，关机消抖时间默认为 64ms。

噪声环境中的 $\overline{PB}$ 引脚

坚固的 $\overline{PB}$ 引脚设计用于噪声环境中工作。低于地电位（>–6V）和高于 VIN（<33V）的瞬态不会损坏坚固的 $\overline{PB}$ 引脚。此外，$\overline{PB}$ 引脚可承受高达 ±10kV 的 ESD HBM 冲击。

为防止外部噪声耦合进入 LTC2954，应在 $\overline{PB}$ 引脚附近放置 R-C 网络。对于大多数噪声应用，5.1k 电阻器和 0.1μF 电容器即可满足要求（见图 8）。

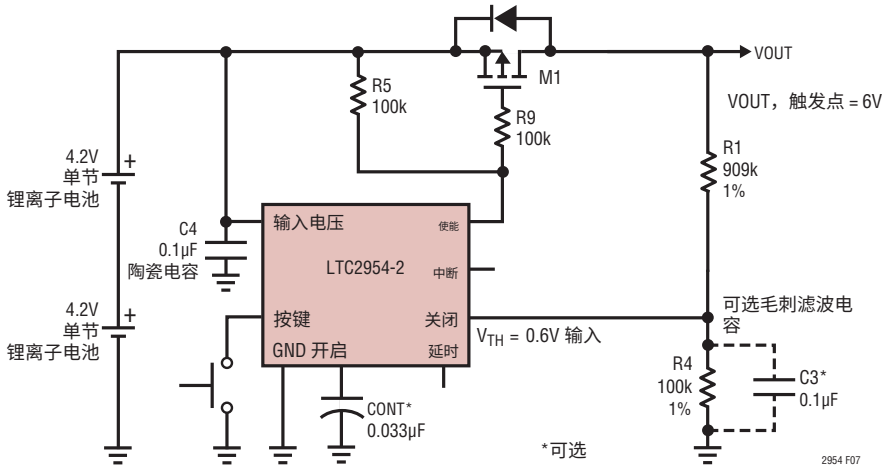


图7。 带6V欠压检测的电源路径控制

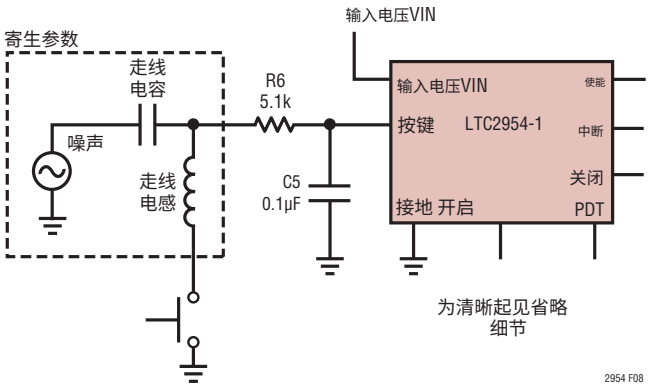


图 8. 有噪声的按键走线

TYPICAL APPLICATIONS

External Pull-Up Resistor On $\overline{PB}$

An internal pull-up resistor on the $\overline{PB}$ pin makes an external pull-up resistor unnecessary. Leakage current on the $\overline{PB}$ board trace, however, will affect the open circuit voltage on the $\overline{PB}$ pin. If the leakage is too large (>2µA), the $\overline{PB}$ voltage may fall close to the threshold window. To mitigate the effect of the board leakage, a 10k resistor to V_{IN} is recommended (see Figure 9).

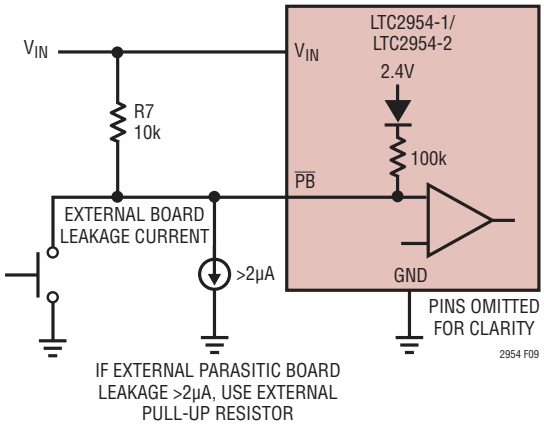


Figure 9. External Pull-Up Resistor On $\overline{PB}$ Pin

Reverse Battery Protection

To protect the LTC2954 from a reverse battery connection, place a 1k resistor in series with the V_{IN} pin (see Figure 10).

典型应用

按键引脚上的外部上拉电阻

按键引脚上的内部上拉电阻使外部上拉电阻变得不必要。然而，按键板走线上的漏电流会影响按键引脚的开路电压。如果漏电流过大（>2μA），按键电压可能接近阈值窗口。为减轻板上漏电流的影响，建议在输入电压处接入10k电阻（见图 9）。

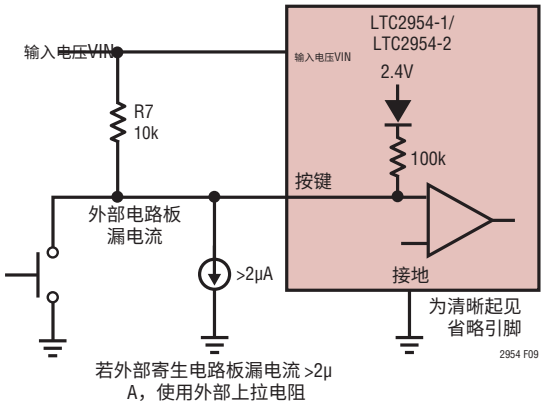


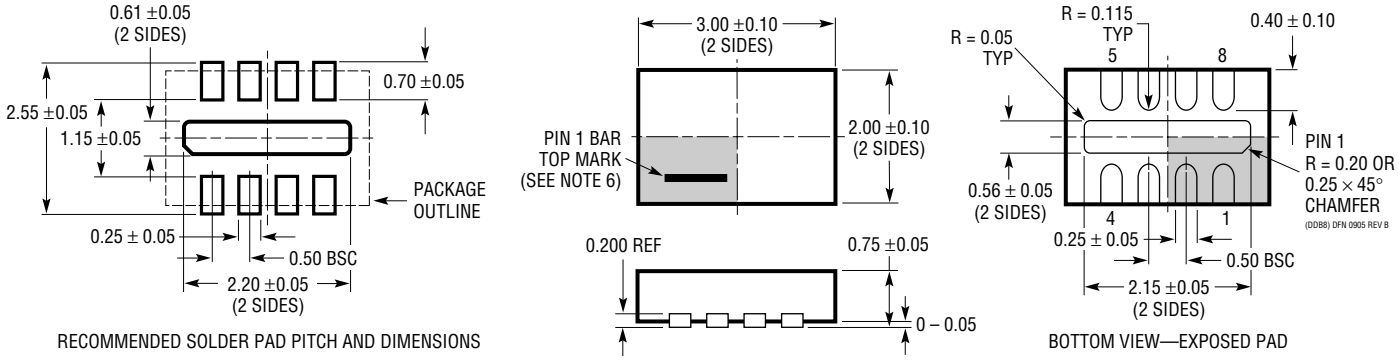
图 9. 按键引脚上的外部上拉电阻

反向电池保护

为保护LTC2954免受反向电池连接影响，在VIN引脚串联一个1k电阻（见图10）。

PACKAGE DESCRIPTION

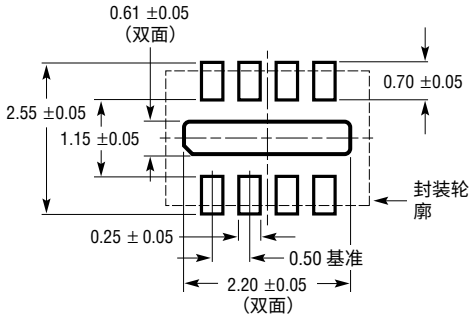
DDB Package
8-Lead Plastic DFN (3mm × 2mm)
(Reference LTC DWG # 05-08-1702 Rev B)



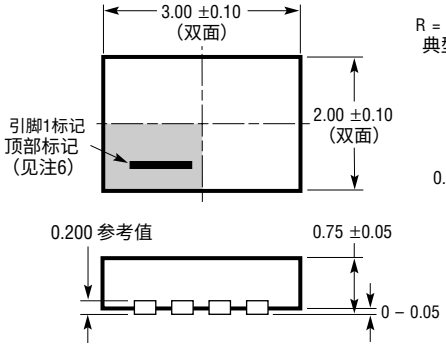
NOTE:
1. DRAWING CONFORMS TO VERSION (WECD-1) IN JEDEC PACKAGE OUTLINE M0-229
2. DRAWING NOT TO SCALE
3. ALL DIMENSIONS ARE IN MILLIMETERS
4. DIMENSIONS OF EXPOSED PAD ON BOTTOM OF PACKAGE DO NOT INCLUDE
   MOLD FLASH. MOLD FLASH, IF PRESENT, SHALL NOT EXCEED 0.15mm ON ANY SIDE
5. EXPOSED PAD SHALL BE SOLDER PLATED
6. SHADED AREA IS ONLY A REFERENCE FOR PIN 1 LOCATION ON THE TOP AND BOTTOM OF PACKAGE

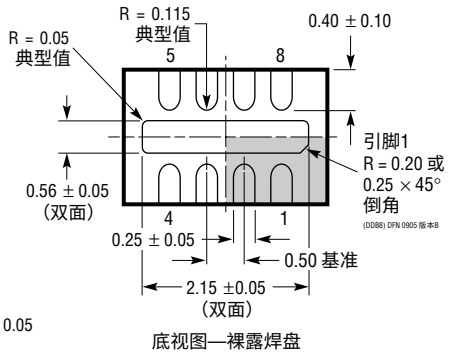
封装说明

DDB封装
8引脚塑料DFN（3毫米 × 2毫米）
（参考LTC图纸编号05-08-1702版本B）



推荐焊盘间距及尺寸





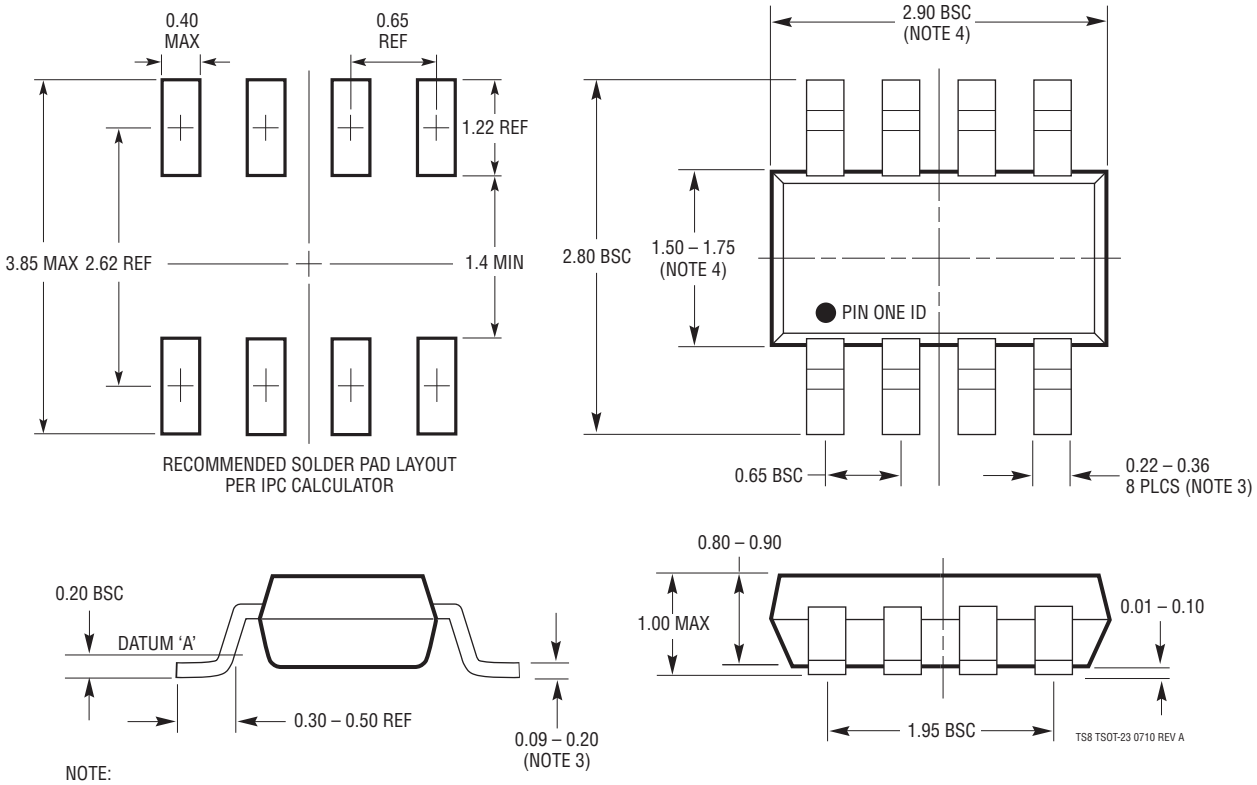
底视图—裸露焊盘

注意：
1. 图纸符合JEDEC封装轮廓M0-229中版本（WECD-1）
2. 图纸非按比例绘制
3. 所有尺寸单位为毫米
4. 封装底部裸露焊盘尺寸不包括模具闪光。模具闪光（如存在）任一侧
   不得超过0.15毫米。裸露焊盘应进行镀锡处理

6. 阴影区域仅作为封装顶部和底部引脚1位置的参考

PACKAGE DESCRIPTION

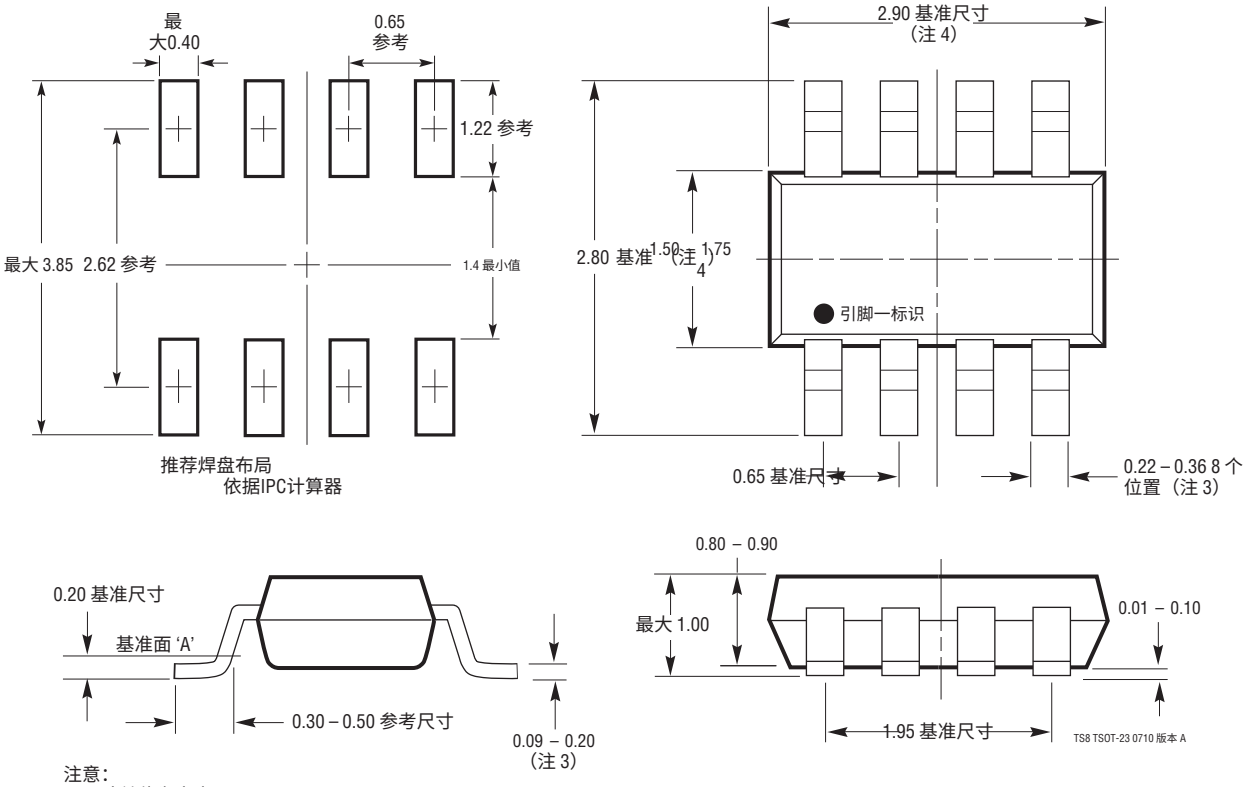
TS8 Package
8-Lead Plastic TSOT-23
(Reference LTC DWG # 05-08-1637 Rev A)



NOTE:
1. DIMENSIONS ARE IN MILLIMETERS
2. DRAWING NOT TO SCALE
3. DIMENSIONS ARE INCLUSIVE OF PLATING
4. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH AND METAL BURR
5. MOLD FLASH SHALL NOT EXCEED 0.254mm
6. JEDEC PACKAGE REFERENCE IS MO-193

封装说明

TS8 封装
8引脚塑料TSOT-23
(参考LTC图纸编号 05-08-1637 版本A)



注意:
1. 尺寸单位为毫米
2. 图纸非按比例绘制
3. 尺寸包含镀层
4. 尺寸不包含模具闪光和金属毛刺
5. 模具闪光不得超过 0.254 毫米
6. JEDEC 封装参考为 MO-193

REVISION HISTORY (Revision history begins at Rev B)

REV	DATE	DESCRIPTION	PAGE NUMBER
B	2/11	Revised Pin Descriptions for EN and $\overline{EN}$ pins	6
		Revised notes for Figures 5 and 6 in Typical Applications	12

修订历史

（修订历史自版本B起）

版本	日期	产品描述	页码
B	2/11	修订EN和 $\overline{EN}$引脚说明	6
		修订典型应用中图5和图6的注释	12

TYPICAL APPLICATION

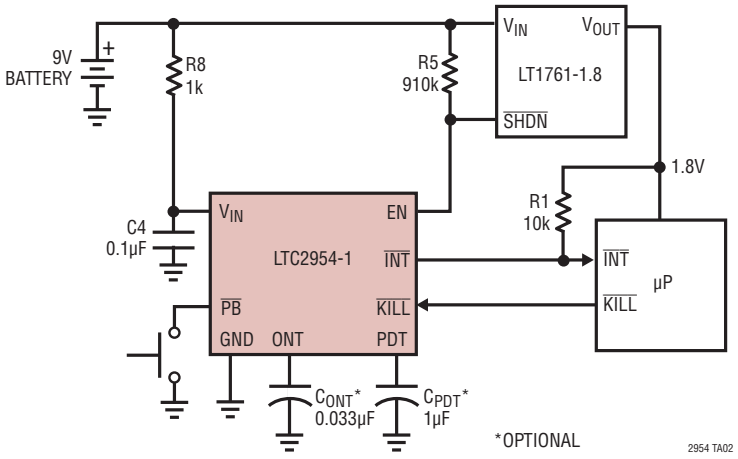


Figure 10. Reverse Battery Protection

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LTC2900	Programmable Quad Supply Monitor	Adjustable $\overline{\text{RESET}}$, 10-Lead MSOP and 3mm × 3mm DFN Packages
LTC2904/LTC2905	Pin-Programmable Dual Supply Monitors	Adjustable $\overline{\text{RESET}}$ and Tolerance, 8-Lead SOT-23 and 3mm × 2mm DFN Packages
LTC2909	Precision Triple/Dual Input UV, OV and Negative Voltage Monitor	6.5V Shunt Regulator for High Voltage Operation
LTC2910	Octal Positive/Negative Voltage Monitor	Eight Adjustable Inputs (0.5V)
LTC2914	Quad UV/OV Positive/Negative Voltage Monitor	Adjustable UV and OV Trip Values
LTC2950/LTC2951	Pushbutton On/Off Controllers	High Voltage, Low Power Pushbutton Controller with Power-Down Fault Detect $\overline{\text{KILL}}$ Timer
LTC4411	2.6A Low Loss Ideal Diode in ThinSOT	No External MOSFET, Automatic Switching Between DC Sources
LTC4412HV	Power Path Controller in ThinSOT	Efficient Diode-ORing, Automatic Switching Between DC Sources, 3V to 36V
LTC4055	USB Power Controller and Li-Ion Charger	Automatic Switchover, Charges 1-Cell Li-Ion Batteries
LT4351	MOSFET Diode-OR Controller	Wide Input Range: 1.2V to 18V
LTC2952	Pushbutton PowerPath™ Controller with Supervisor	Automatic Low Loss Switchover Between DC Sources
LTC2953	Pushbutton ON/OFF Controller with Voltage Monitoring	High Voltage Pushbutton Controller with 200ms Voltage Reset Monitor

Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com
LT 0211 REV B • PRINTED IN USA

典型应用

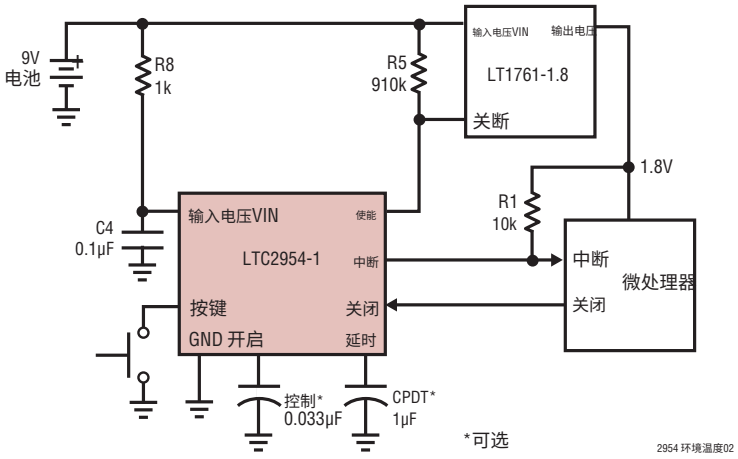


图10。 反向电池保护

相关器件

零件编号	产品描述	备注
LTC2900	可编程四路电源监控器	可调复位，10引脚MSOP和3mm × 3mm DFN封装
LTC2904/LTC2905	引脚可编程双路电源监控器	可调复位和容差，8引脚SOT-23和3mm × 2mm DFN封装
LTC2909	精密三路/双路输入欠压、过压及负电压监控器	6.5V分流稳压器，适用于高压操作
LTC2910	八路正负电压监控器	八个可调输入（0.5V）
LTC2914	四路欠压/过压正负电压监控器	可调欠压和过压触发值
LTC2950/LTC2951	按键开关开启控制器	高压低功耗按键开关控制器，带电源关闭故障检测 KILL定时器
LTC4411	2.6A低损耗理想二极管，ThinSOT封装	无需外部MOSFET，直流电源自动切换
LTC4412HV	ThinSOT封装电源路径控制器	高效二极管或接，直流电源自动切换，3V至36V
LTC4055	USB电源控制器及锂离子充电器	自动切换，充电1节锂离子电池
LT4351	MOSFET二极管或接控制器	宽输入范围：1.2V至18V
LTC2952	带监控功能的按键开关PowerPath™控制器	直流电源间自动低损耗切换
LTC2953	按键开关开启/关闭控制器	带200ms电压复位监测的高压按键开关控制器

Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417 (408) 432-1900 •传真：(408) 434-0507 •www.linear.com
LT 0211 REV B • 美国印刷